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ELECTRICITY IN COUNTRY HOUSES.

We have not infrequently dwelt upon the advantages of electric power in the home, and we have called particular attention to the conveniences thus obtainable, and to the comfort and cleanliness brought by the introduction of the incandescent lamp and a few little motors. These facts are being realized by many households, and the electrical power is fairly taking up many cares of the home. This is, of course, true only in those localities where cheap electrical energy is obtainable; but in the large cities where modern electrical systems exist, and in those districts near large water powers, the comforts procurable through a well-considered use of electricity, are being realized by a rapidly increasing number of families.

There are, however, large districts where cheap electrical energy is not available. These are usually country places supplied only by small electric systems, or situated so far from the large power-house that the cost of transmission brings the price of electrical energy up to a figure which prevents its general use. In such cases, some other source of energy must be provided if the home is to take advantage of the adaptability of the electric motor. The means by which this may be done are interestingly discussed in an article by Mr. Putnam A. Bates, which appears in the July issue of the Journal of the Franklin Institute. Mr. Bates believes that the electric motor may be used with advantage, not only in the large country home, but the farmer will find that it will solve many of his problems which are now becoming serious. There has been a decided drift of men with some aspiration to become a little better than clerks or bookkeepers, from the city to the country. To support themselves, these men necessarily turn to farming or some other industry which can be carried on there. One of the difficulties with which they have to contend is the securing of competent and reliable help. Mr. Bates believes that a well-planned equipment of electric motors will enable the farmer or dairyman to get along with less help, and will make it possible for him to do much of the work which he could not undertake without some form of mechanical drive. Further, the existence of a source of cheap power will lead to improved methods of farming and dairying. A cold-storage room can easily be fitted up for preserving dairy and farm products; and mechanical devices driven by motors will transform the work of the farmer or dairyman from one of hard labor into one in which his chief duty will be the control and management of various machines. In other words, he will become the superintendent of a special mill, instead of the colaborer with his farm hands, which he was before.

To apply these methods successfully, it is, of course, essential that the cost of so doing shall not be large. It is just here

that the main difficulty has lain. Mr. Bates believes that a suitably planned gas-engine-driven dynamo, operated in conjunction with a storage battery, will provide the desired supply, and will do this at a moderate cost. Such an equipment is not difficult to care for and requires little attention, and if intelligently run, would practically take care of itself, with occasional inspection. The batteries would, of course, provide the demand for energy at any time of the night or day; and they can be kept charged by running the generating unit at such times as are convenient. Equipment can, of course, only be installed at some expense, and it is hardly to be expected that every farmer will immediately adopt the system. In some cases co-operation among neighbors might produce the most satisfactory result. But in any case, an equipment of this kind should be carefully designed and not put in haphazard, or left entirely to the judgment of the first sales-man who comes along. The farming industry, including all its branches, lies at the foundation of the prosperity of the country; and it will be strange indeed if the use of electrical energy, which is bringing about such important changes in other industries, does not introduce new methods here. The change may be slow in coming, but come it will in time.

JOIN THE INSTITUTE.

Too many of the younger engineers available for membership in the American Institute of Electrical Engineers neglect to join that body and bring to it their support in the form of the small contributions called dues and the resulting increase of membership. They are too apt to take a narrow, selfish view, saying they can get the papers and discussions printed by the Institute for less than the yearly dues and there is, therefore, no reason why they should pay more. Such men fail entirely to realize the advantages which come from merely being a member of a recognized engineering society. Any one who attends any of the meetings of the Institute gets far more out of the discussions than he can from any published report, while the mixing with his brother engineers brings him other returns equally as great. Moreover, the membership list of the Institute to-day is the recognized roll of electrical engineers and every one turns to it to find out where such and such a friend is, or what electrical engineers there are at any particular place.

These, however, are the selfish reasons of belonging to the Institute, and there are many more of them, as well as others more altruistic, which are convincingly presented in the article contributed to this issue by Mr. Charles B. Burleigh. Every electrical man who is not a member of the Institute should read Mr. Burleigh's argument and reflect upon what he says. But there is one reason which perhaps more than all others should induce electrical engineers to support the Institute. This was well stated by Lord Bacon in his Maxims of the Law: "I hold every man a debtor to his profession; from the which as men of course do seek to receive countenance and profit, so ought they of duty endeavor themselves by way of amends to be a help and ornament thereunto."

A NOTEWORTHY ELECTRIC LIGHTING INSTALLATION.

The Union Station put into service in Washington, D. C., recently is probably the most complete building of its kind in the world. Not only its size, but the many kinds of service connected with it presented a number of engineering problems of unusual interest. One of these is that of lighting satisfactorily all parts of this large structure. A year or so ago this problem would have been attacked by a rule-of-thumb method, and the result, which would have been accepted without comment, would probably have been far from satisfactory. But to-day few features of such buildings receive more consideration than the lighting. We have learned how negligent we formerly were in such matters, and are rapidly approaching the point where the general public will be quick to appreciate good illumination. For these reasons the description of the lighting system installed in the Washington station, which is given elsewhere in this issue, will be interesting to many.

The lighting in the small rooms and offices of the station presented no unusual features. Fixtures have been installed here enabling any of the new high-efficiency lamps to be used. One interesting part of the lighting system is that in the ticket lobby, which is lighted by skylights during the day. Here high-candle-power tungsten lamps have been placed above the skylights so as to give an illumination representing as nearly as possible that provided during the day. This plan has been tried elsewhere, with very good results.

Another difficult room to light is the main waiting room, a room 120 feet wide by 230 feet long, with an arched ceiling ninety-eight feet above the floor at the highest point. The architectural design of this room offered an opportunity for indirect lighting by means of lamps placed behind the galleries on the sides of the room and over colonnades connecting the galleries at the ends of the room. By using inverted open-arc lamps with screens of tinted glass, corrugated reflectors and magnetic deflectors throwing the arc toward the room, which produce a uniform illumination of the ceiling, a very fine effect has been secured. There is ample illumination for reading at every part of the room, so that no other fixtures have been necessary. The objection so often found with such systems of illumination, namely, that the intensely lighted ceiling is hard on the eyes, will hardly hold in this room, because of the shape of the ceiling and its height above the floor.

A third difficult room to light is the main concourse, a space 755 feet long by 150 feet wide. This is lighted during the day by skylights; and the same scheme found satisfactory in the ticket lobby was tried. Due, however, to the structural steel work supporting the roof, this was unsuccessful, there being too many shadows cast upon the skylights. The plan finally adopted was the hanging of direct-current arc lamps seven feet below the ceiling. The height of these lamps above the floor enabled a uniform distribution to be obtained, and places them out of the direct line of vision. There are other interesting features about this installation which are well worthy of careful study.

ELECTRIC CABS.

A few years ago a number of electrically propelled cabs were put in service in London, and great hopes were expressed that they would solve, in part, at least, the difficult problem of handling London traffic. The advantages of a quiet, clean and easily controlled vehicle were fully explained at that time, and all that was needed to give the electric cabs a permanent place on the London streets was a practical demonstration of the cheapness of this method of transportation. Unfortunately, it was just here that the cabs failed, and after a time they were retired from the streets.

Now again we learn that the electric cabs are about to be given another trial in London, and it is to be hoped that they will be more successful this time than before. Doubts are expressed, however, in some quarters because the preliminary estimates of the cost of running the cabs and the probable traffic they will secure do not seem to be sufficiently conservative. The cabs are expected to make about thirty-seven miles a day and to earn $10. This is at the rate of twenty-five cents a mile, including the unproductive mileage, and it is thought that this estimate is much too high. On the other hand, the cost of charging and maintaining the batteries would be about six cents a mile, and cost for repairing tires three cents a mile, and the other items of cost are in proportion. The first cost of the cabs, including batteries, but not tires, will be $2,100. Under these conditions success seems rather problematic.

However, electric cabs have been found successful elsewhere where the conditions are more favorable. There would be a much better chance to keep them on the London streets if they could make fifty or sixty miles a day, but at the comparatively low fares which are charged in London the outlook for success is none too good. There is no doubt that the electrically propelled vehicle is much the most suitable for city service. It is noiseless and under better control than any other; it can quickly take advantage of openings in the traffic and it leaves behind it no offensive trail. For use in the country it is handicapped by its limited range of travel, but in city work this disadvantage is largely removed. The electric cab will doubtless come to its own in London before long, but under the present conditions it will have much to contend with.

SCIENTIFIC SYMBOLS.

On another page of this issue we publish a communication from Mr. Miles Walker, on the subject of scientific symbols. This has been prepared at the request of the British Electrotechnical Commission, in view of the fact that different symbols are employed to represent the same thing in different countries, and the great difficulty of securing uniformity in this matter. The old and very good custom of employing the initial letter of the name as a symbol for the thing is not without faults, because the various quantities have different names in different languages, and hence the symbol in one language does not conform to the name in another. Moreover, when such symbols are employed, it may be necessary to use the same letter for a number of different quantities: hence has arisen the practice of indicating which quantity is represented by adding a subscript or accent to the symbol—an undesirable complication. On the other hand, when arbitrary letters are employed as symbols there is nothing to indicate for what they are intended, so that they must be memorized.

For these reasons Mr. Walker does not think that a modification of the present system of using letters as symbols, even though uniformity could be secured, is quite satisfactory. He therefore suggests arbitrary signs, each having some significant shape which will make it easy to remember; and in his communication he suggests a number which are unquestionably appropriate. In proposing these Mr. Walker considers not only the reader and the writer, but also the printer, and he says he has found that the latter would not be much opposed to the addition to his numbers of types. There would be objection with machine composition. But even at the present time all formulæ and other parts of articles employing special type must be set up by hand. This not only occasions delay, but complicates the work. In this respect, of course, the suggestions would not put us in any worse position than we are in at present, as even the use of accented letters very often calls for hand composition; but it is unfortunate that some plan can not be suggested which would avoid this objection. It is the only one we can see to the proposed scheme; as certainly the use of a significant symbol which can mean nothing else, and which is easily remembered, has much to commend it.

THE GROWTH OF THE ALUMINUM INDUSTRY.

One of the triumphs of applied electric chemistry has been the adding to the materials of the engineering world a new metal having very valuable properties. Prior to the introduction of the electrolytic methods of producing aluminum it was reduced from one of its compounds by the use of metallic sodium. The production then was but a few pounds a year, the metal being used for a few very special purposes where lightness was essential, and to supply chemical museums. In 1883, for instance, but eighty-three pounds of this remarkable metal were produced in the United States, although at that time its virtues were fully appreciated and there was no lack of raw material. The cost of production, however, placed it beyond consideration for mechanical purposes.

The introduction of several electrolytic methods of extracting aluminum from its ore at once raised the metal to an important position in the mechanical world, simply because the cost of production, and hence the price of the metal, were very greatly reduced. Thus by 1890 the output had increased to 61,000 pounds in this country alone; the following year it jumped to 150,000 pounds; four years later, in 1895, it was over 900,000 pounds, and it passed the million mark the following year. In 1900 over 7,000,000 were produced and in 1904 8,600,000 pounds were consumed. Last year the consumption was over 17,000,000 pounds, making the total production in this country since 1883 over 100,000,000 pounds. This has been indeed a most noteworthy growth of a new and important industry.

LORD KELVIN'S PHILOSOPHY.[1]

EXPLANATION IN TERMS OF FORCE OR OF MOTION? ACTION ACROSS EMPTY SPACE OR THROUGH A MEDIUM?

BY SIR OLIVER LODGE.

One of the most interesting and important outcomes of last year's meeting of the British Association at Leicester was the declaration by Lord Kelvin, during a memorable discussion on the constitution of the atom, in Section A, that he had found it necessary to abandon the attempt to contemplate the material universe explicitly in terms of æther and motion, and for his own part preferred to resort to the Boscovich doctrine of centres of force acting on each other according to some curiously complex law, without specific attention to the hypothetical medium in which such forces may exist.

Now undoubtedly these ancient postulates of matter and force represent the dynamical method first made feasible by Newton's achievement in celestial physics, whereby phenomena were correlated by unexplained particles of matter acted upon by unexplained forces, of statical origin and unknown mechanism, according to a specified law of distance. This was how Newton successfully solved the problems of gravitation, and constructed the working theory of astronomy; but it had been hoped, and by some is still hoped, that the time had now come for seeking to represent, in terms of something simpler and more fundamental, the nature of matter and the origin or inner mechanism of its various forces.

The most powerful and hopeful lever wherewith to attack this great philosophical problem was the kinetic theory of elasticity and rigidity, introduced by Lord Kelvin himself. By this means it has been hoped to express force in terms of the still simpler conception of motion; in fact, to explain all the forces with which physicists have to do—electrical and chemical attraction, elasticity, magnetism, cohesion and perhaps gravitation—in terms of the internal motions of a universally connecting fluid plenum.

But now the question arises, Is it at all certain that the material universe can really be understood in terms of motion alone—motion of an all-pervading continuous fluid known as the æther of space? And would such a solution be satisfactory?

To many it has seemed that this reduction to simplicity was the closest approach to ultimate explanation and unification that could be hoped for in the domain of mathematics and physics; and during the last half-century many steps, apparently in the direction of such an achievement, have been taken by the leaders in these branches of human knowledge.

The mathematical foundation was laid by Helmholtz when he reduced rotational or vortex motion in perfect fluid under the domain of mathematics; it was followed up by Lord Kelvin's kinetic or gyrostatic theory of elasticity and rigidity; so that mathematicians, such as FitzGerald, Heaviside, Larmor, Hicks, J. J. Thomson and others, as well as Lord Kelvin himself, have, from various points of view, endeavored to devise a scheme of spinning motion in a perfect fluid plenum which should be able to accomplish in general terms all that the æther is known to perform: more particularly that it should be able to imitate its faculty of transmitting the transverse or solid quiverings that we call light, yet without resisting the motion of bodies through it; and at the same time that it should be able to maintain its own turbulent or whirlpool motion in an unconfused and regularly stable condition throughout infinite time. And in this difficult undertaking they have from time to time seemed partially successful; at any rate, they have reached suggestive results and opened up stimulating vistas.

The æther must be incompressible, too, being perfectly continuous without breaks or any kind of atomic or granular structure, save such as may be conferred upon it by reason of its infra-material internal motion. An infinitesimally turbulent liquid of some kind seemed the desideratum, and many have been the attempts to devise such a liquid. An interlaced system of vortex fibres or filaments has to some seemed the most likely device; a similar scheme was a system of plates or laminar vortices; while a third modification conceived it as a collection of connected filaments all in a state of rapid internal motion, though stationary as regards locomotion in space—what might be called a vortex sponge. By some such means it was hoped to be able to combine the elastic rigidity appropriate to a solid, with the penetrable unresistance to motion of solids through it, characteristic of a perfect fluid, and with the complete incompressibility of an ideal liquid. But the mathematical difficulties of all such treatment have been rather overwhelming; and an uncertainty about the stability or permanence of such a medium has always obtruded itself in a discouraging manner.

In fact, there has always been a troublesome amount of instability in all the schemes that have hitherto been devised, so that none of the expounders of the motion doctrine was able to announce a finally satisfactory result.

Still it was felt by most of those who have worked at the subject that the outlook in this direction would be so bright, if initial difficulties could be overcome, that it was worth a long-continued effort to see if a coherent scheme could be planned on these lines, so as to secure what, if it turned out to be the truth, would surely be a magnificent generalization.

Indeed, it has sometimes seemed unlikely that a mode of explanation which offered such attractive features, and led so far in the right direction, could, after all, be a blind alley leading nowhere; or, to vary the metaphor, a mere will-o'-the-wisp which it was waste of time to pursue.

What has certainly been made out is that motion of atomic structures, in an æther with elasticity postulated, supplies a complete working scheme on which we can rest without inquiring further as to the origin of this elasticity. Beyond this, the attempt to explain the material universe on a purely kinetic basis has not made much progress in quite recent years; and, to those competent to attack it, it has probably seemed better to let the problem lie dormant for a time, until future discoveries in mathematics or in physics throw more light upon the rocky path or provide us with better instruments for climbing it.

During the epoch of waiting it now appears that our venerated chief was deflected from further attempts in this direction, and directed his attention elsewhere. Other methods seemed to him more immediately hopeful; and whereas it had been hoped to explain force in terms of latent motion, Lord Kelvin in later years sought to expound motion in terms of force, giving up the kinetic unification of the material universe in favor of a conception more arbitrary and descriptive, and permitting himself to regard force as perhaps an equally fundamental, perhaps a more fundamental, conception than motion.

It may be that philosophers will concede the (to me) somewhat improbable proposition that an explanation in terms of force and action at a distance will be as satisfactory as an elucidation in terms

[1] Being thoughts suggested by the meeting of the Mathematical and Physical Section of the British Association at Leicester in August, 1907; and referred to in Sir Oliver Lodge's recent presidential address to the Faraday Society, May 26, 1908. From *Nature*. London, July 2.

of motion and a continuous medium. To Lord Kelvin it would appear that both solutions were equally satisfactory, and that it was only a question of which was the more tractable. In any case it is noteworthy that he took up so clear and definite a position; it is the key to much of his recent work, and to the difficulties which he felt in accepting some of the hypotheses which are a natural consequence of the electrical theory of matter and of some of the facts of radioactivity. It now seems not unnatural that he should have sought to express and explain these great results otherwise. His attitude is both coherent and reasonable; though I would urge that most theoretical advance and discovery (in the hands of Maxwell and others) has been along the continuous and medium line, which, if not the line of ultimate explanation, is at any rate that of achievement.

At the same time it must be admitted that, if a longitudinal impulse is transmitted by an incompressible medium at an infinite pace, the process becomes barely distinguishable from action at a distance, through a force varying according to a specified law. Or—putting what is virtually the same thought in another way—the influence of an electron, or matter unit, whose field of force extends infinitely in all directions, need not be conceived as limited by some arbitrary boundary beyond which things can be said to be at a distance from it.

It will be remembered that some of the old philosophers saw great difficulties in the abstract conception of motion. It appears as a curious evanescent transition from one place to another, involving the attribute of "time"; it is indeed "not a being but a becoming," when position is taken as the primary conception.

But I urge that it is simplest to regard "position" and "distance" as secondary conceptions, subordinate to and arising out of our perception of motion. Unless motion is supposed to be a thing directly apprehended, it is truly rather an elusive idea. To me it seems a direct apprehension—direct information conveyed by our muscular sense. Space itself seems a consequence deduced from our perception of motion; and the idea of time follows from our direct perception of rapidity of motion. But probably to Lord Kelvin these things appeared otherwise.

The conclusion of the discussion on the constitution of the atom may be summed up thus:

The internal energy of Lord Kelvin's model atom is static or potential. The internal energy of the hypothetical atom at which others are working is kinetic.

The disintegration of radium in the former case is comparable to the explosion of an unstable chemical compound, like guncotton. In the latter case it must be represented by something more akin to the flying to pieces of a single rapidly spinning unit, such as a flywheel.

And so for the present the matter stands.

The New British Patent Act.

The effects of the new patent act, which compels foreigners exploiting patents in Great Britain to manufacture the article mainly in that country, have come as a great surprise to many manufacturers here, says the New York *Journal of Commerce*. It is understood that the full advantage is likely to be taken of the clause which advocates the legal protection of foreign patents after August 28. Such patents may be revoked on application by any person to the Comptroller of Patents if granted four years ago to any foreigner who manufactures exclusively or mainly outside of the United Kingdom.

Already a large number of foreign firms have secured factory sites, and a syndicate of German chemical manufacturers has taken a site of twenty-four acres in the vicinity of the Mersey, while a large German electric company is negotiating for another large site, and many foreign inquiries for sites in the Manchester district are being received. The Hoechst Farbwerke and Messrs. Cassella & Company are building a factory for dye manufacture at Ellesmere Port, situated upon the Manchester Ship Canal.

The Board of Trade states that last year 2,608 patents were granted to Germans and 2,792 to Americans by the British Patent Office. Sir Joseph Lawrence, who, with Ivan Levinstein, framed the act, gives the following summary of the effects of the former laxness of the British patent laws:

Estimated British loss by diversion of aniline dye industry, from £5,000,000 to £20,000,000 per year. German chemical industry, yearly overturn, £70,000,000. Amounts paid to foreign countries for telephone apparatus, £10,000,000. Yearly amount of wages lost in telephone industry, £500,000. Value of imported motor cars and cycles in the last three years, £5,500,000.

An English trader taking out a patent in Germany must work it in that country, so that the German has little to complain of if the same regulation is applied to him. Some German patentees will get English firms to manufacture their goods, but that also will mean a great increase in wages, etc., for English work people. Thousands of firms on the Continent and in America must either take this course or build factories in England if their British trade is to be maintained. France will be affected in its motor-car trade, but the chief sufferers will be Germany and America.

National Fire Protective Association on Incandescent Lamp Hazard.

The Underwriters' laboratories have issued the following bulletin dealing with the hazard of exposed bases of certain incandescent lamps:

"For the proper safeguarding of life and property the National Electrical Code prescribes that no live parts of an incandescent lamp base shall be exposed when the lamp is in the socket. Underwriters' laboratories and manufacturers of sockets, receptacles and incandescent lamps have co-operated for several years for the establishment of standards whereby this result has been accomplished for the bases of common carbon filament lamps. The newer high-efficiency lamps, such as the tantalum and tungsten, require a metal extension or 'skirt' over the bulb beyond the Edison screw base. Designs have been developed and adopted by American manufacturers for constructing these high-efficiency lamps in such a manner as to insulate this skirt from current-carrying parts of the base and so secure in these types the same degree of protection as that already obtained for the older patterns. Some of the foreign manufacturers are, however, supplying lamps having exposed skirts not insulated from the circuit.

"Your attention is respectfully called to the desirability of giving preference to lamps having no live metal parts exposed when placed in the standard socket, which has a depth of fifteen-sixteenths inch in a vertical plane from the bottom of the centre contact to the upper edge of the outer socket shell or wall."

In the equipment of manufacturing plants one of the most interesting features, during the past two years, has been the introduction of steam turbines into a great variety of industries, from factories of different kinds, where about the same quantity of power is used continuously during the day, to cement plants, steel mills, smelters, etc., where the load fluctuates violently from one moment to another. Flour-mill and sawmill operators were among the latest to join the procession of turbine users, and now a tannery—one of the largest in the world—the Pfister & Vogel Leather Company, has just ordered two Allis-Chalmers turbine units, each of 1,500 kilowatts capacity, or a total of 4,000 horse-power, for the new plant to be built in Milwaukee. Another unit of the same size has been purchased by the Pueblo & Suburban Traction and Lighting Company, Pueblo, Col., and the city of Holland, Mich., will install one of 750-horse-power capacity.

SYMBOLS FOR PHYSICAL QUANTITIES.

BY MILES WALKER.

It is very desirable to have a notation for the representation of physical quantities in scientific books and periodicals which shall be the same in all languages.

The subject is under the consideration of the International Electrotechnical Commission with a view to international agreement, and committees in the different countries (in England under the chairmanship of Lord Rayleigh) are discussing this particular subject. They are dealing more especially with symbols for electrical and magnetic quantities, but the system might with advantage be extended to embrace all important quantities in physical science, especially as the subject is receiving the attention of most technical societies with a view to some action being taken in the matter.

There are, however, two great difficulties which arise when we try to fix upon a standard notation.

The first is the difficulty of persuading a number of writers and readers who have become accustomed to a certain symbol for a certain quantity to change it in favor of an equally large number of writers and readers who have become accustomed to another symbol.

In the second place, there are not enough letters in the two or three alphabets at our disposal to give a distinct symbol to each quantity without resorting to the combination of more than one letter to form a single symbol. There is a great objection to this combination of letters because the use of sub-script letters and numbers is required for distinguishing between particular quantities of the same general kind.

There is, moreover, an objection to using letters at all to represent quantities in a universal notation because, unless initial letters are used, there is no connection in the mind between the letter and the quantity, and the symbol is difficult to remember. We can not always use initials because the initial letters differ in different languages. Moreover, the same initial occurs for a great number of different quantities.

One way of avoiding the above difficulties would be to create a number of new symbols which could be printed by means of type like ordinary letters, and which would represent each physical quantity in a distinctive manner.

The question, however, arises as to whether a number of entirely new symbols would be acceptable to writers, readers and printers alike, and the subcommittee on symbols appointed by the British section of the commission has requested the writer to place his views publicly before the profession with a view of obtaining suggestions and criticisms as to the feasibility of such a scheme from as wide a circle as possible.

In choosing a symbol we would try to make a very simple picture of something that reminds us of the quantity in question. For instance, ⌇ might represent temperature. If we were told that this simple outline of a thermometer represents temperature we would have no difficulty in remembering it. Similarly, / might represent force, and the various "forces" might be derived from it; for instance, ϟ electromotive force (conventional representation of lightning), and ∩ magnetomotive force.

It is not my purpose here to say what would actually be the best form of symbol for each quantity, but it is not a difficult matter to devise very simple characters which can be written quickly, easily and with sufficient accuracy, and which can at the same time assist the memory to connect them with the quantity for which they stand.

What would the printers say to the new type? The author has taken up this matter with a very large publishing firm, and is assured by their chief expert that 200 or 300 new type would be a small matter to a modern printer, who is already accustomed to deal with many hundreds of different fonts, each of which contains from thirty to 120 different symbols. He estimates that a printer in a large way of business has at his command as many as 60,000 distinct type, differing from each other either in letter, size, body or face. The addition of 200 or 300 more would be a drop in the ocean. The size of the new type could be standardized for most purposes, and it would only be in some special case that another size would be called for.

The setting up of the formulæ with the standard size of type would be simpler than with the present system, in which sub-script letters are often unnecessarily introduced. One symbol under the present system sometimes consists of four or five letters.

If it be admitted that the introduction of new symbols is advisable, the question arises what shall the new symbols represent exactly? Shall the sign ⌇ (Temp.) represent temperature in any units, or shall it represent the number of degrees of temperature, measured by some scale agreed upon, and embodied in the definition of the symbol? If the system of units employed be not prescribed, fewer symbols would be required, and the general writer who now says vaguely "Let T equal the temperature" would find the symbol sufficient for his purpose. But from the reader's point of view there is much to say in favor of a symbol which will embody in its definition a standard system of units. Any formula expressed in such symbols would be completely self-contained and would be an exact statement of a physical fact. Until the units employed in any formula are known, the formula expresses only half its meaning. Perhaps some slight addition to the symbol, or even to the whole formula, might be used to indicate that the standard system of units is employed. Without that addition the symbol would have a general meaning. For instance, ⌇ might equal temperature, while ⌇ might indicate the degrees centigrade above the absolute zero. The name of the type might be the name of the physical units which it represents; for instance, for ϟ we might read "volts."

If writers, printers and readers who have any definite views as to the best method of devising a system of symbols would communicate with the technical press, or with the author, they might assist in solving the many difficulties which arise in connection with this matter.

The Cottage, Leicester road, Hale, Altrincham, England.

Aluminum Industry.

The magnitude of the aluminum industry is shown by the following, which gives in pounds the production in the United States since the beginning of the industry in 1883:

1883, 83; 1884, 150; 1885, 283; 1886, 3,000; 1887, 18,000; 1888, 19,000; 1889, 47,468; 1890, 61,281; 1891, 150,000; 1892, 259,885; 1893, 333,629; 1894, 550,000; 1895, 920,000; 1896, 1,300,000; 1897, 4,000,000; 1898, 5,200,000; 1899, 6,500,000; 1900, 7,150,000; 1901, 7,150,000; 1902, 7,300,000; 1903, 7,500,000; 1904, 8,600,000; 1905, 11,347,000; 1906, 14,910,000; 1907, 17,211,000; total, 100,530,779.

The value of the exports of aluminum and manufactures of aluminum of domestic production for the last four years has been as follows: 1907, $304,938; 1906, $364,251; 1905, $290,777; 1904, $166,876.

The Copper Situation.

A sale of 1,000,000 pounds of electrolytic copper was made recently to a large corporation on a basis of eleven and seven-eighths cents per pound. The contract calls for delivery within the next two months.

Copper producers and selling agencies declare that the demand for copper shows some improvement locally. Many of them are of the opinion that a buying movement of some proportions from local consumers will be under way before the close of the year. The increase in orders for electrical equipment indicates a large consumption of copper.

The falling off in production in June was due largely to the big decline from Butte, a fifty per cent shrinkage, compared with May, by reason of the flood. The Butte output amounted to but 13,000,000 pounds, against 26,000,000 a year ago. With the Greene-Cananea still closed down, Mexico likewise continues to show a large decrease.

The shortage of 118,000,000 pounds of copper during the first six months of this year, as compared with two years ago, under high copper prices, must, of necessity take care of a large portion of the decrease in consumption in this country; and it helps to sustain the claim that with any improvement in business, and a stocking up by the large consuming interests, a scarcity of available copper might quickly develop.

A new source of copper supply comes in this month, namely the Ely district of Nevada. After an expenditure of over $15,000,000, the concentration of Ely ores is now taking place, and the smelter will blow in some time this month, so that from now on Nevada will figure in copper production. That state, however, will not be able to supply over 20,000,000 pounds this year, so that with a decrease already of 95,000,000 pounds this year the supply of copper will not do much to fill up the gap.

A careful canvass, made about a week ago, of all the available supplies of copper to be had of the New York selling agents developed the availability of only 5,000,000 pounds of copper at thirteen cents per pound and under. This has since been licked up, so that there is no electrolytic to be had in quantity under thirteen cents per pound. Lake is still quoted at thirteen cents.

The General Electric Company has recently contracted for several million pounds of copper at thirteen cents per pound. It bought the Lake brand, something which it never does if electrolytic can be had for less money. This copper was bought for delivery in September and October.

One of the largest producers of copper in the country says: "While I have been lukewarm with regard to the possibility of anything approaching a stampede among copper buyers, on the ground that a readjustment of the general business situation would be a matter of many months, I am to-day firmly convinced, after a thorough study into the conditions existing here and abroad, that there is every chance of another runaway market in copper after Taft is elected.

"Many buyers will postpone the placing of their orders until the election of Taft has been actually accomplished. It isn't enough for them to be confident of another Republican victory, they must read the returns.

"I notice there is considerable talk of large accumulated supplies in this country and particularly abroad. That is all humbug. Suppose the amount of stock in foreign warehouses is at the highest figures for several years and stands at 37,000 tons; what does that amount to? These figures, applied to the world's necessities, represent but a few days' supply.

"Then again there is a tendency to underestimate the present American consumption because comparison is made with the very excessive and abnormal consumption of 1906 and the first half of 1907. Compare the present consumption with 1905, or any normal period, and it will be found that the amount of copper to-day going into the manufacture of all sorts of brass and copper goods compares very respectably with former years."—*Wall Street Journal.*

The Electrical Equipment of the Royal Mint, London.

A description is given here of the electrical equipment of the Royal Mint in London, England, which has replaced the old mechanical drive installed in 1882. The old arrangement consisted of a number of underground shafts connected with the various machines through gearing and, until 1905, it served to drive the greater number of machines in the mint. As extensions to the mint had became necessary the losses due to the shifting became excessive so that the whole was converted over to the electric drive, the power being supplied to the various motors from a steam-driven generating plant, which takes the place of the old engines. This plant comprises two 200-kilowatt, direct-current generators connected to high-speed engines. There is in addition a small gas engine driving a fifty-kilowatt generator for use when the steam plant is not in service and for charging a storage battery. The latter is rated at 5,000 ampere-hours, at an eight-hour discharge, and built up of fifty-eight cells. Ventilation in this room is provided by grate openings in the walls, in place of windows. These batteries carry all the lighting when the generating plant is not in service and are capable also of carrying a considerable motor load. Lighting and power mains are kept as far as possible distinct. Until 1907 the average monthly output of the generator was 19,600 kilowatt-hours. There are sixty-four motors in the mint and the combined rating is 600 horse-power. A few typical applications are as follows: A fifteen-inch rolling mill is driven by a seventy-horse-power motor through a spur gearing, and the cutting machines are driven from two line-shafts each belted to a ten-horse-power motor. In the annealing room the gas-heated rotary furnaces are turned by motors rated at one to ten horse-power. The coin-press room contains nineteen presses driven through a line-shaft by a thirty-horse-power motor. There are a number of counting machines driven by motors rated at two or three horse-power. —*Electrical Review* (*London*), *July* 10.

Power for Montana Mines.

Various financial and mining interests, including Senator Clark, H. H. Rogers, ex-Governor Hauser and others who represent the Missouri River Power Company, have arranged with the Stone & Webster Engineering Corporation, of Boston, for the development of the extensive water-power resources on the upper Missouri River in Montana, on a scale exceeding anything that has been undertaken in this country since interest in large developments began to lag over a year ago. The plans provide ultimately for the generation of 50,000 horse-power by means of two dams and power plants.

It is estimated that the construction work planned will cost $3,000,000, and it will be done in two stages: the first will be the building of a concrete dam to afford 20,000 horse-power at Hauser Lake, sixty miles from Butte. This work will be begun by the contractors immediately.

Subsequently it is planned to build a new concrete dam about 1,800 feet long and 110 feet in height, together with a 30,000-horse-power hydroelectric plant at Wolf Creek, a few miles above Hauser Lake. From this plant the power will be transmitted at a high voltage to Butte and to Helena.

The Electric Lighting System of the Washington Union Station, Washington, D. C.

THE Washington Union Station, Washington, D. C., which has just been completed, presents some very interesting problems in lighting and power requirements. The property consists of: The Union Station, said to be the largest and most magnificent railroad station in the world; Express Building, occupied by the Southern, Adams and United States express companies; power plant, locomotive and car repair shops, coach yard and several signal towers.

The power plant supplies electric current for light and power, steam for heating, compressed air for cleaning, brake testing, signals, etc., and water for drinking, house service and fire protection, to the station, express building and adjoining yards and also light and power to the coach yard, repair shops and signal towers. Separate power plants furnish heat, compressed air and water service to the shops and coach yard.

Service connections from the power plant to the express building and station are made through a pipe subway or tunnel. Piping for water, heating and refrigerating service is carried on supports suspended along the centre line of this subway while vitrified tile ducts, with manholes at convenient intervals, are built into the wall for the electric service.

Cables for electric service north to the coach yard, repair shops and signal towers, are carried through a line of vitrified tile ducts laid in concrete between the tracks. Concrete manholes provided with cast-iron covers, are located from 250 to 300 feet apart on straight runs, and at convenient points where the duct system crosses streets. Manholes are connected to the general drainage system.

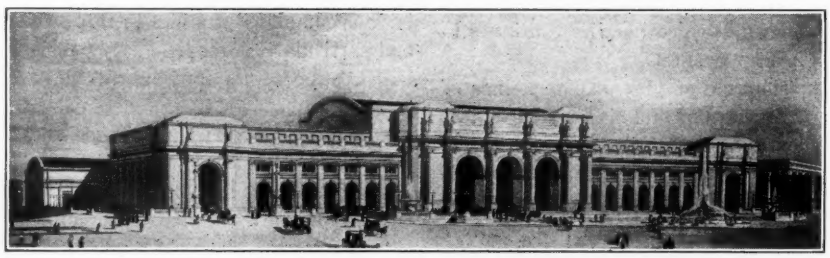
The best of materials only is used in the lighting and power systems in order that they shall be as lasting as the building construction. Conduit furnished by the Safety Armorite Conduit Company, electro-galvanized both inside and outside, is used throughout, the smallest size installed being three-quarters-inch. In the inspection of conduit the specifications, with reference to weight and dimensions, were very rigidly enforced, the requirements in this respect being the same as for standard weight steam pipe. All short-radius bends were factory made and galvanizing was performed after bends were formed. All other bends were made by hand in the field and the heating of conduit for this purpose was prohibited.

Outlet, junction and all boxes for low-tension service are of heavy cast-iron construction. In many instances it was thought advisable to use specially designed material and apparatus in order to provide a lighting and power system in keeping with the other construction. Threaded connections, reinforced by locknuts and bushings are used throughout between conduit and outlets in order to provide a continuously grounded system. In addition, the conduits are brought into contact with the steel framework of the buildings and at transformers, the neutrals of which are in every case grounded, a common ground connection is made.

The high-tension distributing system for incandescent lighting and power purposes is operated at 2,300 volts and sixty cycles. Each transformer for lighting purposes and each set of transformers for power purposes is served by an independent cable direct from the switchboard at the power-house. Cables for arc service have either four or eight conductors and serve from two to four loops. All motor-driven apparatus is operated from three-phase lines while all incandescent lighting service is taken from one phase of the generators in order to secure as good regulation as possible and to simplify the wiring.

All cables running north to the coach yards, shops and signal towers are lead-covered on account of the presence of moisture in the duct system. Those to the south are double-braided only, as the ducts in the wall of the pipe subway are reasonably dry and are protected from moisture. The single and three-phase, 2,300-volt cables are insulated with varnished cambric over a thin layer of unvulcanized rubber. These cables were subjected to and successfully withstood a test of 7,500 volts for five minutes between conductors, and between conductors and ground, after being submerged in water for twenty-four hours at the factory, and 5,000 volts for five minutes between conductors and the ground after being installed. Insulation resistance averaged well above 150 megohms per mile. The arc cables, both four and eight-conductor, have each conductor insulated with rubber with varnished cambric over all. These were made up to withstand a test of 10,000 volts at the factory and 8,000 volts after being installed under the conditions mentioned above. Insulation resistance averaged about 4,500 megohms per mile. All high-tension cables were furnished by the General Electric Company.

General Electric new type H transformers, with a ratio of ten to one, are used and are placed in fireproof vaults located at convenient points in the basement of the various buildings. The vault walls are of brick and are built solid from the floor to the ceiling. The floor space generally covers an area of about 100 square feet giving sufficient room for the changing of transformers and parts without disturbing transformers in service. Vault doors are constructed of iron lined with asbestos, and are equipped with lock and keys, and are of sufficient height and width to facilitate the removal of apparatus.

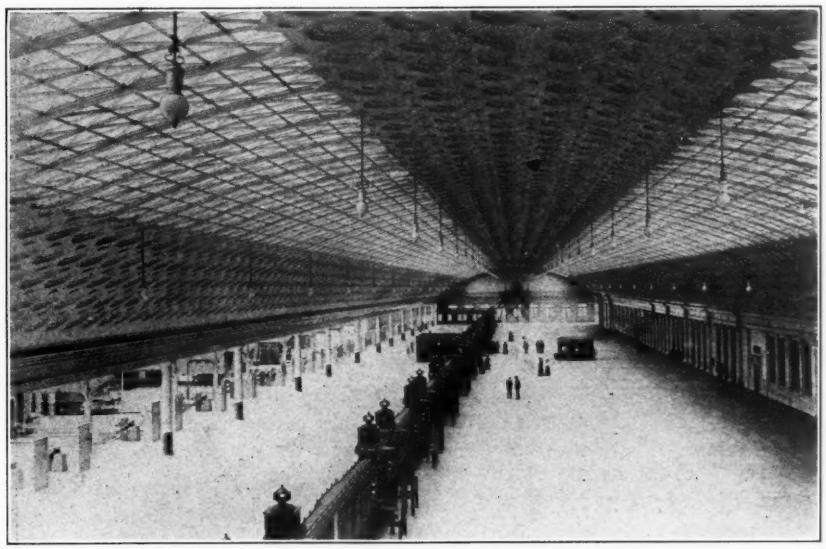


FRONT VIEW OF UNION STATION, WASHINGTON, D. C.

The high-tension cables in each vault terminate at a set of disconnecting switches mounted on the wall above the transformers. Expulsion type fuses are installed between the switches and transformers. Low-tension feeder distributing panels, encased in quarter-inch sheet-metal cabinets, are mounted on the outside of the vault walls at either side of the door, connection to the transformers being made through iron-pipe conduit.

Three-wire, 113-226-volt feeders are run from the feeder cabinets to distributing cabinets located at convenient points throughout the buildings, each feeder serving from one to five or six distributing cabinets. Distributing panels are encased in heavy sheet-metal cabinets and are equipped with three-wire busses and two-

wire branches. Feeder circuits, buses and branch circuits are invariably controlled by knife switches, branch circuits being protected by plug fuses and buses and feeders by type A fuses. To secure mechanical strength no switches smaller than twenty-five amperes are used on branch circuits or smaller than 150 amperes on main circuits.



CONCOURSE LIGHTING, UNION STATION, WASHINGTON, D. C.

After a number of distributing cabinets had been installed a change was made in the District regulations to permit the grounding, under certain conditions, of all electric fixtures not connected to gas piping. The general scheme of wiring was accordingly changed to profit by this change in regulations. All insulating joints are eliminated entirely. The neutral wire of the branch circuits is grounded to the conduit system at both the fixture outlet and the distributing cabinet—at the latter by means of a copper wire running entirely around the panel in the wiring space and connected with each neutral wire and the conduit system. The neutral wire of feeder circuits is also grounded to the conduit system at cabinets and at transformers by means of a ground plate laid in charcoal under the vault floor. Neutral fuses in all feeder circuits are eliminated and solid copper bars substituted.

WEST END OF WAITING ROOM AND TICKET LOBBY, UNION STATION, WASHINGTON, D. C.

Okonite compound, of the thickness called for under United States navy yard and dock specifications for low-tension wires, is used for insulating all the secondary wires. Feeders and tie lines are single-conductor and branch circuits twin-conductor. No electrical tests were required prior to installing. After installing, tests for insulation resistance gave results from three to twenty times greater than called for by the District regulations.

The lighting of large floor spaces is generally accomplished by the use of series direct-current arc lamps. General Electric form 10 and 11 lamps are used throughout and are suspended from cone-shaped insulators screwed into the outlet boxes. Loops from the power-house control from twenty-five to thirty-seven lamps each, individual groups being controlled by Gilbert porcelain cutouts enclosed in cast-iron cases conveniently located. Solid No. 8 wire, insulated with Okonite compound and run in one and one-quarter-inch conduit is used for arc service.

All other lighting, except that in the ticket lobby, which is furnished by tungsten lamps, is furnished by metallized carbon filament lamps.

In selecting the lighting units for each particular case, careful consideration was given to the relative efficiencies, reliability and maintenance costs of all commercial lighting units, the conclusion being based upon data obtained from laboratory tests and from many installations in operation.

UNION STATION.

The Union station, passenger concourse, and train sheds cover a ground space of more than eighteen acres. Thirty-three tracks, served by nineteen platforms, enter from the north. Thirteen merge into two which continue to the south under the station and through twin tunnels running between the Library and the Capitol under First street. The sub-basement and concourse basement are used for baggage purposes. The station basement is occupied by a portion of the ventilating and other service machinery and several transformer vaults, the balance of the space being held in reserve for future requirements. The first or street floor is occupied by the main waiting room, ticket offices, baggage room, dining and lunch rooms, women's room, smoking room and state apartments. The kitchen is located on the second floor. The balance of the second floor, the third, and a part of the attic floors are used for office purposes.

MAIN WAITING ROOM.

In the preliminary design of the main waiting room it was decided to use some system of lighting by which the fixtures and lamps would be concealed. The room covers a floor space of 120 feet wide by 230 feet long, and has a barrel-shaped ceiling of sixty feet radius, the highest

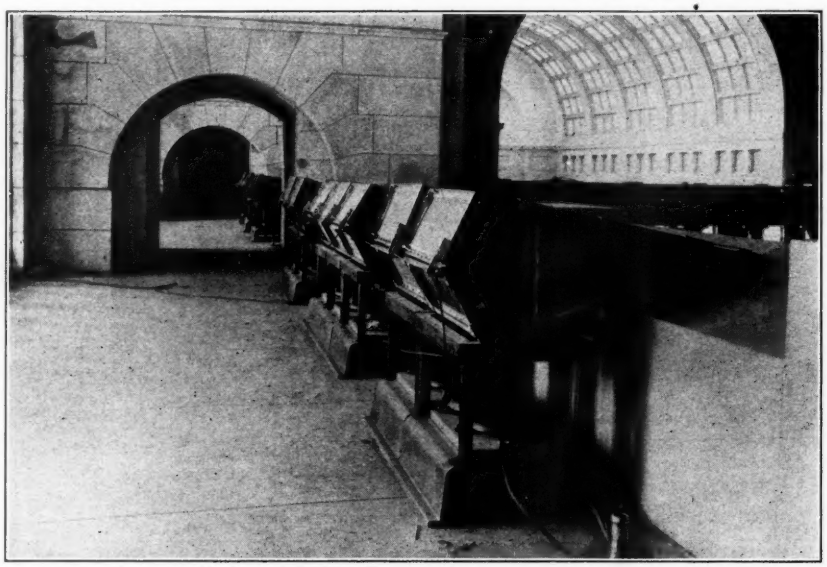
point of which is about ninety-eight feet from the floor. A series of five alcoves which form galleries over the entrance vestibules, run along the sides of the room, with colonnades connecting the galleries across the ends of the room. The ceiling is light in color and is decorated with gold leaf. While not elaborate, the decorations are rich and in complete harmony with the fixtures and architecture.

Banks of especially constructed inverted series arc lamps are placed in the alcoves and back of the balustrade on top of the colonnades, with corrugated mirror reflectors behind them to throw the light to the ceiling whence it is reflected to the floor. As an aid to the reflectors, magnetic coils, which tend to draw the arc toward the waiting room, are installed on the lamps and give good results. To soften the light and reduce the bluish-white tint characteristic of arc lamps, "Cathedral Glass" screens of a very light yellow tint are placed over the lamps and reflectors.

The lighting equipment consists of a total of 162 lamps so arranged that several combinations in the number of lamps in service may be had. A series of luxometer readings were taken with all possible combinations of lamps. From the results of these tests it was found: That the corrugated reflectors and light-colored ceiling give almost perfect diffusion; that with all lights burning, at reading distance from the floor, about forty-two inches, the illumination is practically uniform, the curves both north and south, and east and west being nearly a straight line, and the values varying from 2.5 foot-candles in the corners of the room to 2.3 foot-candles in the centre thus making the use of auxiliary lighting on the seats for reading purposes not only unnecessary but out of harmony in color and arrangement with the general scheme employed. The light is a very close approach to daylight and gives practically true color values in every part of the spectrum. Considerable difficulty was experienced in procuring the glass used to soften the color of the light, as it is required that the glass should not absorb too much of one or all colors. By the use of the "Cathedral Glass" and clear inner globes a loss of but sixteen per cent in the light was entailed, that being less than with an opal inner globe alone.

TICKET LOBBY.

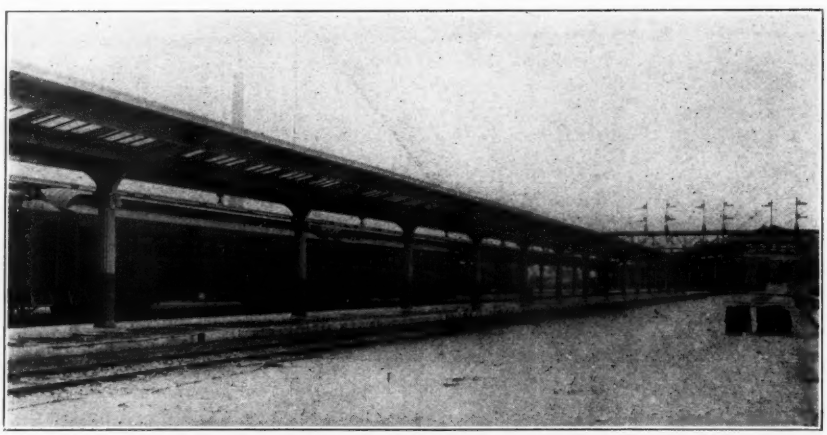
The ticket lobby, located at the west end of the waiting room, is approximately 100 feet long by fifty feet wide with a barrel-shaped skylight ceiling for natural lighting in the daytime. At first the use of a system of lighting similar to that in the waiting room, but with smaller units, was considered. A study of the conditions and tests of the glass indicated that it would be less expensive both in construction and maintenance to install individual lamps above each skylight. Tungsten lamps of 100-watt size with metal reflectors painted inside with aluminum paint are used. The lamps are arranged on four three-wire circuits, controlled by single-pole switches, so that half the lights may be cut out of service without disarranging the symmetry of the lighted panels. The illumination in this portion of the station averages about 2.3 foot-candles, the quality of the light closely approximating that in the adjoining main waiting room and the distribution being equally as good. The reflectors used are of a special design and are so mounted as to direct the light toward the centre axis of the arch. There are in all 225 lamps above the skylight, all being in a pendent position. A very small percentage of the light passes up, the major portion being directed down into the lobby below.



REAR VIEW OF REFLECTOR-FRAMES IN ALCOVE, UNION STATION, WASHINGTON, D. C.

BAGGAGE ROOM.

The baggage room on the first floor is lighted during the daytime by seventeen saw-tooth skylights through a ceiling of maze glass panels. For artificial illumination one arc lamp is placed above each ceiling panel with good results. Each lamp is equipped with a large reflector. The skylight tile-work has also been painted white with most pleasing results. The effect has been to destroy shadows and color rings, to smooth out and enlarge the distribution of the light, to make the color more mellow and in harmony with

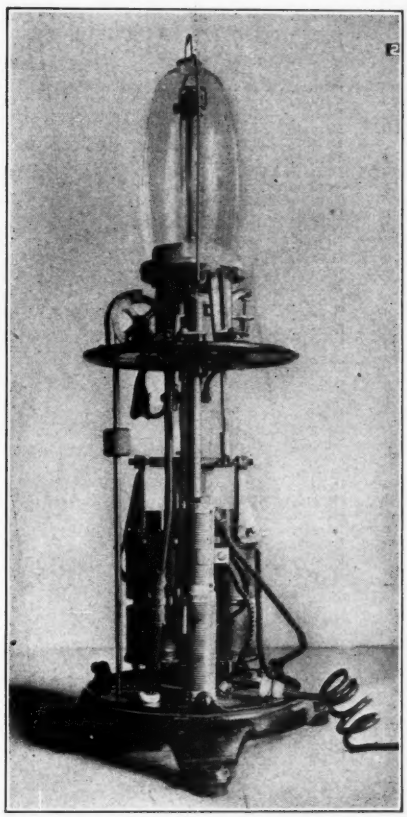


TRAIN SHED LIGHTING, UNION STATION, WASHINGTON, D. C.

that in the adjoining ticket lobby, to direct all the light downward and to reduce the annoying effects of flickering, arc traveling and feeding. The illumination in this room averages about 1.8 foot-candles and is both comfortable and sufficient for the work performed.

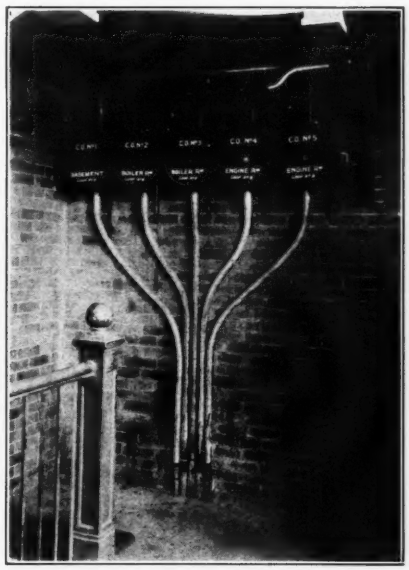
CONCOURSE.

The concourse occupies a space 755 feet long by 150 feet wide between the station building and train shed. It serves as a means of passage to and from trains and



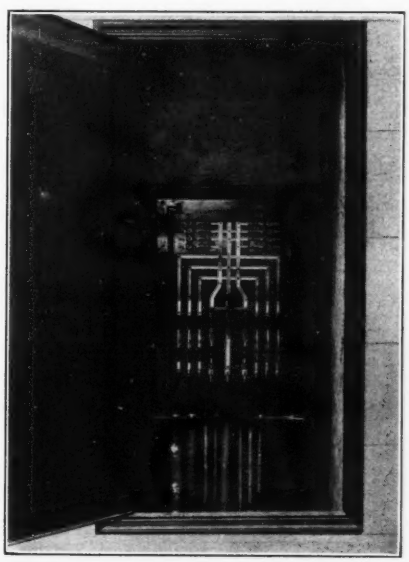
INVERTED ARC LAMP, CASING REMOVED.

is lighted entirely by arc lamps suspended about seven feet from the ceiling. At this distance from the ceiling the lamps cast very slight shadows overhead. The absence of pronounced shadows is desirable on account of the paneling in the ceiling. It was attempted experimentally to light this space by placing arc lamps between the roof and ceiling over the skylights. The scheme was condemned principally on account of the steelwork supporting the roof casting very pronounced shadows on the skylights and because the glass used has a very large absorption factor and is not uniform in color when lighted artificially. Series direct-current arcs did not give good results on account of the great loss due to absorption. Flaming arcs, by reason of their great quantity of light, gave good results but were abandoned because of their pronounced yellow color being out of harmony with the general color values in other parts of the station and the high



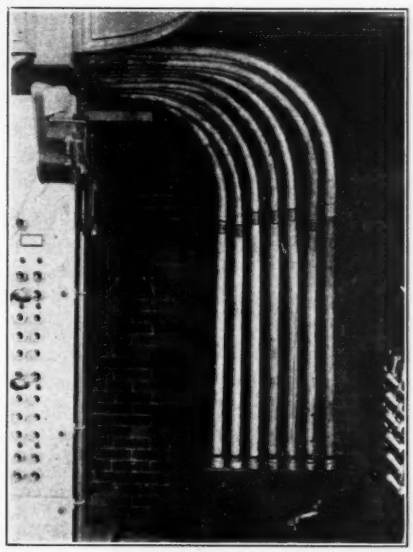
ARC CUTOUTS WITH CONDUIT CONNECTIONS.

cost and difficulty of maintenance in the positions they occupied. Other experiments were also made in an effort to reduce the total number of units used, by employing large diffusers containing four and five units each. This, however, gave the effect of large units of high intrinsic brilliancy and was for that reason aban-



TYPICAL DISTRIBUTING PANEL AND CABINET.

doned. It also produced objectionable streaks and shadows on the ceiling. This system would undoubtedly have worked out well had the ceiling been designed so as to have the diffusers set in it instead of below it. The reasons for abandoning this system were due to the original layout not conforming to its use and not to any faults in the diffusers themselves. With the diffuser installation the illumination on the floor was sufficient, pleasant and well diffused, the streaks and shadows on the walls and ceiling being due to the nonconformity of the building design and the necessary method of installation. Each lamp is equipped with a clear inner and opal outer globe and the quality and distribution of the light is as good as could be desired. Means have been provided for a suitable casing to cover the wires and insulator directly above the lamp and a canopy to improve the appearance at the ceiling outlet. A collapsible and movable extension ladder is used in trimming these lamps.



CONDUIT IN POWER-HOUSE.

MISCELLANEOUS.

The dining and lunch rooms, women's room, smoking room, state apartments and porticos are lighted from a series of ornamental bronze fixtures. These fixtures show excellent workmanship, and are in strict conformity with the decorations and architectural features of the rooms in which they are placed. The ever-present glare of exposed fixtures, however, is present and the irregularity of illumination is quite pronounced, illumination curves showing a variation in the dining room of from 2.1 foot-candles under the fixture to 0.7 foot-candles along the wall.

Some special lighting, in the form of incandescent lamps with reflectors placed in coves formed in the cornices, is installed in the main entrance to the state

apartments and also in the vestibules. This system gives a very satisfactory effect but the installation is too small to be of much value in gathering technical data. The ticket cases and counters, show cases in the drug store, news stand and flower booth are lighted by Frink reflectors, the lights being concealed as much as possible.

The lighting of the offices is uniform in design. One and three-light fixtures finished in dull black are used. The sockets are arranged for vertically suspended lamps, permitting the use of Tungsten lamps at some future date, and for Holophane shades. Each office is equipped with two or more ceiling fixtures, depending upon the size and shape of the room, and floor and baseboard outlets are installed at convenient locations. All ceiling fixtures are controlled by flush pushes mounted on wood mats on the walls. Hallways are lighted by Gem lamps varying from fifty to 125 watts and are encased in eight, ten and twelve-inch globes, according to size. The kitchen apartments are lighted and ventilated to some extent by combined fixtures and fans.

The train platforms are covered by umbrella sheds supported on cast-iron columns spaced thirty feet apart along the centre line of the platform. One hundred and eighty-seven-watt Gem lamps, equipped with Holophane bowl reflectors, are suspended midway between the columns from especially designed outlet boxes attached to the steelwork of the roof. These give abundant light for loading or unloading trains and are readily accessible for renewals. They may, however, be changed to 100-watt Tungsten lamps later with the desirable results of increasing the quantity of light and decreasing the total energy used. The signs and numerals over the entrance gates in the train fence are illuminated by incandescent lamps controlled by push-button switches located in cabinets containing the numeral boards for the time signs.

The ventilating fans are operated from 226-volt, three-phase service and the dumb waiters from 113-volt, direct-current, from a ten-kilowatt motor generator set. The total load is small and is carried by three seventy-five-kilowatt transformers connected in delta. The Magneta clock

POWER REQUIREMENTS SOUTH OF M STREET.

	Total watts.
Small motors at station	225,000
Train tunnel fans	250,000
Battery charging motor generator	50,000
Motors, power plant and K street tower	120,000
Total	645,000

WASHINGTON TERMINAL LIGHTING SYSTEM.

UNION STATION.

	Sq. Ft.	Watts per Sq. Ft.	Total Watts.	System.	Kind of Lamp.
Sub-basement	9,420	0.58	5,500	Direct.	D.-c. series arcs.
West basement	36,864	1.75	64,600	Direct.	D.-c. series arcs.
East basement	6,352	1.88	12,000	Direct.	Arcs and GEM.
Ticket lobby	5,200	4.25	22,500	Concealed above glass ceiling.	100-watt tungsten.
Ticket office	1,536	2.05	3,150	Direct and concealed.	GEM.
Baggage room	5,236	1.66	8,500	Concealed above glass ceiling.	D.-c. arcs.
Main waiting room	28,320	2.93	83,000	Indirect.	Inverted d.-c. series arcs.
Booth and special lighting main waiting room	....	....	2,000	Special.	GEM.
Smoking room	1,876	2.24	4,200	Direct.	GEM.
Barber shop	612	1.97	1,200	Direct.	GEM.
Toilets	1,818	0.87	1,640	Direct.	GEM.
Telephone space	508	2.26	1,150	Direct.	GEM.
South vestibule	957	2.82	2,700	Direct.	GEM.
Drug store	320	3.43	1,100	Direct.	GEM.
Parcel room	384	2.81	1,080	Direct.	GEM.
North vestibule	2,320	2.58	6,000	Direct.	GEM.
East collonade	320	3.28	1,050	Direct.	GEM.
Women's waiting room	2,720	1.54	4,200	Direct.	GEM.
Women's toilet	1,280	0.78	1,000	Direct.	GEM.
Dining room	7,488	1.73	13,000	Direct.	GEM.
Lunch room	8,352	1.34	11,200	Direct.	GEM.
Steward's office	300	1.00	300	Direct.	GEM.
Serving room	4,352	0.71	3,100	Direct.	GEM.
State entrance porch	2,560	1.09	2,790	Direct and concealed.	GEM.
Vestibule state entrance	720	5.20	3,750	Concealed.	Incandescent.
President's reception room	2,584	1.38	3,600	Direct.	GEM.
President's retiring room	224	2.67	600	Direct.	GEM.
Attendants' retiring room	224	2.67	600	Direct.	GEM.
Invalids' room	352	1.42	500	Direct.	GEM.
East driveway	9,600	0.52	5,000	Direct.	D.-c. series arcs.
East portico	1,344	1.76	2,400	Direct.	GEM.
South portico	7,680	0.52	4,000	Direct.	GEM.
Main entrance porticos	5,544	1.83	10,150	Direct.	GEM.
Carriage porch	11,744	0.84	9,900	Direct.	GEM.
Concourse	98,800	0.37	37,000	Direct.	D.-c. series arcs.
Concourse news stand	169	10.94*	1,850	Direct and special.	GEM.
Concourse ticket office	968	1.39	1,350	Direct.	GEM.
Concourse fire department and toilet	572	1.04	600	Direct.	GEM.
Station master's office	1,147	0.98	1,125	Direct.	GEM.
Stairways to tracks	800	1.87	1,500	Direct.	GEM.
Umbrella sheds	397,440	0.092	82,000	Direct.	GEM.
Train gates	....	....	15,000	Special.	GEM.
Massachusetts avenue tower	384	2.08	800	Direct.	GEM.
East portion second floor	23,728	1.08	25,650	Direct.	GEM.
West portion second floor	16,032	0.91	14,600	Direct.	GEM.
East portion third floor	19,968	1.20	24,000	Direct.	GEM.
West portion third floor	9,276	1.19	11,100	Direct.	GEM.
East portion attic	16,652	0.57	9,600	Direct.	GEM.
West portion attic	17,472	0.20	3,500	Direct.	GEM.
Floor outlet	....	....	30,000	....	....
Total lighting load			557,135		

*Includes show-case lighting.

EXPRESS BUILDING.

	Sq. Ft.	Watts per Sq. Ft.	Total Watts.	System.	Kind of Lamp.
Offices	25,080	1.34	33,000	Direct.	GEM.
Distributing space and offices	25,080	0.76	19,000	Direct.	GEM and arcs.
Storage space basement	25,080	0.78	19,500	Direct.	D.-c. series arcs.
Driveways	33,880	0.33	11,200	Direct.	D.-c. series arcs.
Train shelters	26,670	0.42	11,200	Direct.	D.-c. series arcs.
Plug receptacles	....	....	5,610	....	....
Total			99,510		

K STREET SIGNAL TOWER.

	Sq. Ft.	Watts per Sq. Ft.	Total Watts.	System.	Kind of Lamp.
Offices	3,630	0.60	2,200	Direct.	GEM.
Basement	1,800	0.42	756	Direct.	GEM.
Small motors	....	....	15,000	....	....
Total			17,956		

INSPECTORS' BUILDING.

	Sq. Ft.	Watts per Sq. Ft.	Total Watts.	System.	Kind of Lamp.
Store room and lunch room	4,158	1.20	5,000	Direct.	GEM.
Offices	4,158	1.33	5,500	Direct.	GEM.
Basement	4,158	0.61	2,500	Direct.	GEM.
Total			13,000		

POWER PLANT.

	Sq. Ft.	Watts per Sq. Ft.	Total Watts.	System.	Kind of Lamp.
Boiler room	7,800	1.63	12,716	Direct.	Arcs and GEMS.
Engine room	9,000	1.22	11,000	Direct.	D.-c. series arcs.
Plug receptacles	....	....	28,050	....	....
Total			51,766		

REFRIGERATING PLANT.

	Sq. Ft.	Watts per Sq. Ft.	Total Watts.	System.	Kind of Lamp.
Attic	1,050	0.76	798	Direct.	GEM.
Second story	1,050	1.42	1,500	Direct.	GEM.
First floor	1,050	1.27	1,350	Direct.	GEM.
Basement	1,050	1.85	2,000	Direct.	GEM.
Total			5,648		
Pipe tunnel	....	....	2,500	Direct.	Incandescent.
Train tunnel	....	....	10,000	Direct.	Arcs and incandescent.

SUMMARY.

Total connected lighting load south of M street	757.5 kilowatts
Total connected power load south of M street	645.0 kilowatts
Total	1,402.5 kilowatts

system has been installed, the master clock being wound automatically by a small alternating-current motor. A telautograph system has been installed for the use of employés only, its principal service being to announce to the employés of the baggage room and station and the express companies the time and incoming track number of arriving trains.

The lighting of the signal towers is special to a considerable extent, it being very desirable to have the operating rooms as dark as possible so as to permit the operators to observe readily the movement of trains. All of the track and signal indicators and the lever machines are illuminated by fifty-watt Gem lamps in connection with special Frink reflectors, no other lights being used in the operating room.

EXPRESS BUILDING.

The express building is a three-story brick building somewhat more than 300 feet long by sixty feet wide. The basement or street floor and first or train floors are used exclusively for the handling of express, while the second floor is used for office purposes. The basement and basement driveway, first floor and train shelters are lighted almost entirely by arc lamps, the lamps being controlled by some twelve or fifteen cutouts. The arrangement of the second floor permits the use of a uniform and symmetrical arrangement of lights. One-light ceiling fixtures equipped with Holophane shades and 125-watt Gem lamps are used throughout, the fixtures being placed at the centre lines of windows. This lighting especially has given general satisfaction.

POWER-HOUSE.

The larger floor spaces in the power-house are lighted by arc lamps, while the smaller machinery passage ways and offices are lighted by Gem lamps equipped with Holophane reflectors. The fixtures as a rule are made of one-half-inch conduit instead of three-eighths-inch and without ornamental tubing on the outside. This arrangement gives a very strong and serviceable fixture. A multiplicity of extension-plug outlets is provided, extension cords equipped with Frink lamp guards and Fullman plugs being supplied.

The terminal is equipped with a private telephone exchange connected with the local, long-distance and railroad exchanges. Postal, Western Union and railroad telegraph service also enters the terminal.

With the exception of the ornamental bronze fixtures which were designed and purchased by the architects, D. H. Burnham & Company, of Chicago, Ill., all of the electrical work on the Terminal company's property south of M street was designed by and constructed under the direction of the motive power department of the Pennsylvania Railroad.

All the electrical work above described was installed by A. S. Schulman, of Cincinnati, Ohio. Credit is due I. R. Prentiss, of the General Electric Company, for many valuable suggestions in connection with the lighting of the waiting room and other important portions of the station. W. D'A. Ryan, of the illuminating department of the same company, also gave valuable assistance in this direction.

The tabulation on the opposite page gives an itemized statement of the kinds of lamps used, method of lighting and wattage per square foot for floor space throughout the buildings described in this article.

Coal Production in 1907.

Advance sheets from the United States Geological Survey, George Otis Smith, director, have been prepared by Beatrice D. Wood, bearing on the production of coal in 1907.

In the production of both anthracite and bituminous coal, Pennsylvania in 1907 exceeded any previous annual record, as reported by the United States Geological Survey in an advance chapter of Mineral Resources of the United States, calendar year 1907, on the production of coal, prepared by E. W. Parker.

The total production was 235,925,749 short tons, having a spot value of $319,421,826. The production of anthracite was 76,432,421 long tons (equivalent to 85,604,312 short tons), having a spot value of $163,584,056. The production of bituminous coal was 150,321,437 short tons, having a spot value of $155,837,770.

Compared with the aggregate production of 1906, which amounted to 200,575,617 short tons, valued at $262,208,345, the output in 1907 exhibits an increase of 35,350,132 short tons, or 17.6 per cent, in quantity, and of $57,213,481, or 21.8 per cent, in value. The increase in the production of anthracite coal was 12,787,412 long tons (equivalent to 14,321,901 short tons), or 20.1 per cent, in quantity, and $31,666,362, or twenty-four per cent, in value. In the production of bituminous coal the increase was 21,028,231 short tons, or 16.26 per cent, in quantity, and $25,547,119, or 19.61 per cent in value.

Mr. M. R. Campbell, of the United States Geological Survey, estimates the amount of coal originally in the anthracite fields of Pennsylvania at 21,000,000,000 short tons and that in the bituminous fields at 112,574,000,000 short tons.

The total production of coal in Illinois in 1907 was 51,317,146 short tons, having a spot value of $54,687,382, the largest production and value yet recorded for the state, an increase of 9,837,042 short tons, or 23.72 per cent in quantity, and of $9,924,320, or 22.17 per cent in value, over the production of 1906. By this increase Illinois was again advanced to second place among the coal-producing states, a position it had held from 1883 to 1906, when it was supplanted by West Virginia.

The total production of coal in West Virginia in 1907 was 48,091,583 short tons, having a spot value of $47,846,630.

In 1906 West Virginia displaced Illinois for second place among the coal-producing states, but her triumph over Illinois was of short duration. As a result of the suspension in 1906, ranging from two months to ten weeks at most of the Illinois mines, pending an adjustment of the wage scale, the coal production of Illinois was materially restricted, whereas in West Virginia, where most of the miners are unorganized, operations were carried on practically without interruption, and that state outranked Illinois, with a lead of 1,810,246 short tons. The record for 1907, however, showed that the production of Illinois made a phenomenal increase of 9,837,042 short tons, more than double West Virginia's increase of 4,801,233 short tons, and West Virginia again dropped to third place among the coal-producing states. Compared with that of 1906, West Virginia's coal production in 1907 showed an increase of 4,801,233 short tons, or 11.09 per cent in quantity, and of $6,794,691, or 16.55 per cent in value.

During the first nine months of the year business was exceptionally active, and the demand for coal was considerably in excess of the supply of cars to transport it, but as West Virginia is one of the producers of high-grade steaming and coking coals, the influence of the monetary disturbance of October was keenly felt. Coke making fell off quickly as soon as the panic began, and the coal production of the state during the last ten weeks of the year was probably not more than fifty per cent of the capacity. Had the production kept up for the entire year at the rate exhibited during the first nine months the total production would probably have reached 53,000,000 tons.

Although a good part of the market for Washington coal in California has been lost through the increased production of fuel oil in that state, Washington shared in the general increase in the production of coal in 1907. The total output for the year was 3,680,532 short tons, having a spot value of $7,679,801, an increase of 404,348 short tons, or 12.34 per cent in quantity, and of $1,771,367, or 29.98 per cent in value, compared with 1906. The average price per ton advanced from $1.80 in 1906 to $2.09 in 1907.

During the first ten months of the year the coal-mining industry of the state was in a highly satisfactory condition. In November and December, however, owing to the financial disturbances, the output of the mines was curtailed about thirty-three per cent. But for this the production would probably have exceeded 4,000,000 tons.

SOME ENGINEERING FEATURES OF THE SOUTHERN POWER COMPANY'S SYSTEM.[1]

BY J. W. FRASER.

(Concluded.)

Substations—The first motor installations in cotton mills on this system were of 550 volts, but it was soon seen that the number of small transformer substations, besides complicating operation, would cost excessively, and after some investigation 2,000-volt motors were recommended for all mills converting from steam to electric drive. These installations proved so successful that to-day over one-half the total horse-power in motors is at 2,000 volts. The cost of the conduit in the mills for 2,000 volts is nearly offset by the smaller wire used and this electromotive force permits all mills within a radius of two miles to be fed from one substation. Many new mills, on account of using individual drive and consequently motors below thirty horse-power, are compelled to step-down at least a part of this current to 550 volts.

The sizes of transformers in substations are as follows:

11,000 Volts. (All purchased before beginning of new development.)					44,000 Volts.			
5	Stations with	3	100 kw.		1	Stations with	2	100 kw.
5	"	"	3	125 "	1	"	"	3 125 "
3	"	"	3	150 "	1	"	"	3 150 "
1	"	"	3	200 "	7	"	"	3 200 "
1	"	"	3	250 "	8	"	"	3 300 "
1	"	"	3	500 "	5	"	"	3 500 "
					1	"	"	3 750 "
					4	"	"	3 1,000 "
			7,575 kw.					31,175 kw.

Many of the 44,000-volt substations below 900 kilowatts are now partially or wholly owned by customers, as are also some of the 900-kilowatt and 1,500-kilowatt stations, most of the mills in one town preferring to take shares rather than pay the additional price for power necessary when the station is owned by the power company. The customer usually requests that the power company buy and install the substation apparatus. The customer gets the benefit of any experience which the power company may have and obtains substations at a minimum cost. In the larger towns where attendants must be kept it has been found more satisfactory for the company to own the substation. The power company has discountenanced the buying of transformers below 200 kilowatts on account of the high cost of completed stations per kilowatt. In the case of a 900-kilowatt station (three 300-kilowatt transformers) when the transformer cost is two-thirds of the total and 150 kilowatts cost fifty per cent more per kilowatt than 300-kilowatt transformers, the power company has taken a share in the station rather than have the customer install the small transformers. The companies consider this to be to their interest in view of the facts that they get all new mills and that the interest on the additional investment for two years would not pay the installation charges for substituting the large transformers when they were needed.

All substation transformers have been purchased under a standard specification in order that a few stock transformers which the power company has made it a policy always to keep on hand, may serve as spare apparatus in case of accident.

It is believed that no transformers below 300 kilowatts and very few below

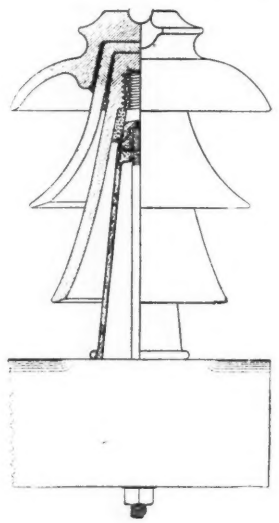


FIG. 6.—44,000-VOLT INSULATOR.

500 kilowatts will have to be purchased in the future, for with the present rapid growth of cotton mills and the use of 2,200-volt distribution in the towns where substations are located, the small transformers will have to be exchanged for larger ones, the smaller ones being available for the new substations carrying small loads.

It may be of interest to some to know that there are now on our lines 114 50,000-volt fuses of the expulsion type and that they have proved entirely satisfactory.

Secondary Power—From government records and from six years of gaugings before the completion of the Catawba plant, together with two years' operating experience, the flow of the Catawba River had been pretty well determined. The question which presented itself most forcibly was whether to develop the average minimum twelve months' flow, or to develop for ten months, eight months or less, and to supplement with steam power; a problem which has to be determined by the first cost of development and by local market conditions.

Owing to limited library facilities at his command the writer was unable to ascertain if this question had been touched upon elsewhere and how in other cases it had been determined, and so trusts that a few words with reference to this particular case will not be amiss.

In following calculations where the cost of primary and secondary power is taken at a fixed rate, the intention is not to convey the idea that these are actual figures but relative figures which will serve the purpose of this paper.

There are many different solutions to the problem of ascertaining the amount of secondary power which may be economically developed. At one of our developments it was found that the average minimum primary power was in the neighborhood of 16,000 kilowatts and that the increase per month of secondary power was in the neighborhood of twelve and one-half per cent; *i. e.*, 2,000 kilowatts per month. In other words, if secondary power was to be developed for eight months' sale the total development of primary and secondary power would be 24,000 kilowatts. If this secondary power can be sold without an auxiliary steam plant the amount of secondary power which may be developed economically depends only upon whether or not the price received for such power will cover interest and profit on the investment; that is, the investment which is over and above that for developing primary power, but if a steam plant has to be maintained the amount of secondary power to be developed depends also on the cost of steam power. It is very clear that the cost of secondary power is practically the same whether it is sold for eleven months or one month. With this cost, say at $10 per horse-power delivered, steam at $28 per horse-power-year ($6 interest and depreciation, $22 for coal, operating expenses, etc.), if interest and depreciation on the steam plant is entirely chargeable to the months when steam plant is in operation, then

Cost of steam power per month $= 1.83 + 6/x$

When $x =$ the number of months in operation.

Amount of secondary power to be developed $=$ 16,000 kilowatts $\times$ $12.5x/100$ $= 2{,}000x$

Cost of steam-secondary $= 2{,}000x\ (1.83 + 6/x)\ x + 2{,}000x \times 10$ $= 2{,}000\ \ (1.83x^2 + 6x + 10x)$

[1] A paper presented at the annual convention of the American Institute of Electrical Engineers, Atlantic City, N. J., June 30. For a description of the different power sites owned by the Southern Power Company see ELECTRICAL REVIEW, September 8, 1906, p 367.

If power is selling at \$20, profit

$= (2{,}000x\ 20 - \{2{,}000\ (1.83x^2 + 16x)\}$

$= 2{,}000\ (20x - 1.83x^2 - 16x)$

(For max.) $dy/dx = 3.66x - 4$

$x = 1.1$ month

On this basis maximum profit would be made on 2,200 kilowatts secondary development.

A more practical method under existing conditions seems to be to charge the interest and depreciation of steam plant to the operating expenses of the system, inasmuch as the steam plant is an insurance

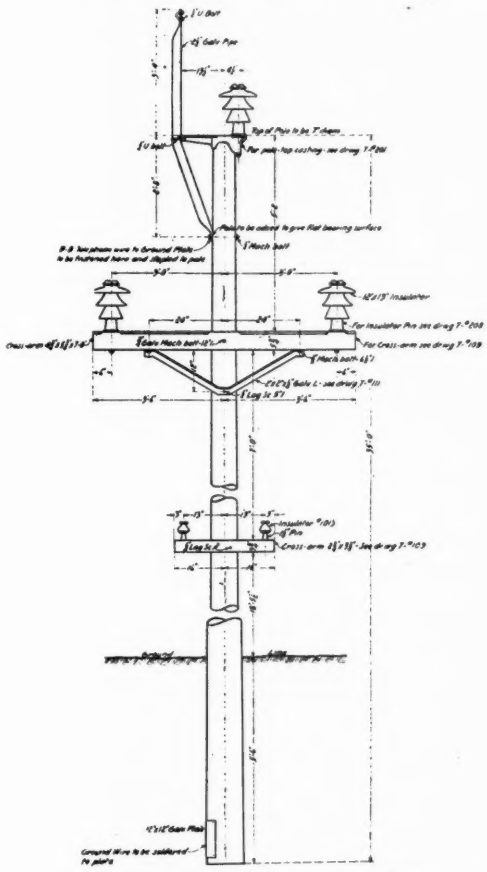


FIG. 7.—STANDARD WOOD POLE.

against a partial shut-down and makes spare units unnecessary, and in the case of steam turbines, when run as synchronous motors, saves copper because it brings up the power-factor. The above equation now becomes:

Cost of steam + secondary

$= 2{,}000x\ (1.83x) + 2{,}000x \times 10)$

$= 2{,}000\ (1.83x^2 + 10x)$

Profit

$= 2{,}000 \times 20 - (2{,}000\ (1.83x^2 + 10x)$

$= 2{,}000\ (20x - 1.83x - 10x)$

$= 2{,}000\ (10x - 1.83x^2)$

(For Max.) $dy/dx = 3.66x - 10$

$x = 2 - 3/4$

Maximum profit on this basis would be made on 5,500 kilowatts (35 per cent) secondary development.

Had \$24.50 been taken as the selling price of power x would equal four months, or the total development should be made for 150 per cent of mean average low water. Although power from hydroelectric plants has been selling in the Carolinas for less than this latter figure there is no doubt that reliable service demands this price.

There is another argument in favor of developing for 150 per cent mean average low water. If it costs only one-half as much to develop secondary power as primary, twice the loss can be allowed on transmission lines; or, in other words, one and one-half times the power can be transmitted during secondary power seasons. Now, if the transmission lines are figured for an economical loss when transmitting primary power only, secondary power to the extent of fifty per cent of the primary power can be developed without additional copper. This only holds good when the auxiliary steam plants can be built in the neighborhood of distribution centres whose consumption of power is equal to the amount of secondary power.

Many mills which had steam plants already installed made contracts for secondary power for eight months in the year, but after a few months' operation by electric drive their owners found the production so much increased and their labor and other troubles so much lessened that many of them desired to change their contracts to primary power. The result of this is that the plans for a supplementary steam plant are now in course of preparation. The initial installation will be 15,000 kilowatts and will be located at Spartanburg, S. C., near the southern end of the system, sixty-four miles from the main switching station at Great Falls on the 88,000-volt line. The ultimate installation is expected to reach 40,000 kilowatts, divided between this point and some point near the eastern end of the system. It is thought better to divide the plant for safety and in order that the line loss may be kept as low as possible.

BOOK REVIEW.

"American Street Railway Investments." New York. McGraw Publishing Company. Cloth. 473 + xliv pages. 10 by 13¼ inches. Illustrated with maps. Supplied by the ELECTRICAL REVIEW for \$5.

This is the fifteenth edition of the electric traction "Red Book." It is hardly necessary to say much about this excellent reference book. The data have been brought up to date and several new maps indicating extraordinary developments have been added. There is no other reference of a similar character, and the book, therefore, stands in a class by itself. It should certainly be of considerable interest to those desiring accurate and recent information concerning street railway properties.

Resistance of a Conductor Having a Sudden Change in Size.

At a recent meeting of the Physical Society, of London, a paper entitled "On the Resistance of a Conductor of Uniform Thickness Whose Breadth Suddenly Changes and on the Shape of the Streamlines" was read by Professor C. H. Lees. A knowledge of the resistance of a conductor whose section suddenly changes is of considerable practical importance, but mathematical difficulties have prevented an exact solution of the problem. Lord Rayleigh had given an approximate solution of the case in which a cylinder of circular section is joined at one end to the plane surface of a large conducting solid; and Professor Hicks has solved the case of a wire of small diameter ending in the surface of a conducting sphere. The mathematical difficulties of the problem disappear if the conductors are of rectangular section and one dimension, *e. g.*, the thickness remains constant while the breadth suddenly changes and the two are joined together either with their axes or with two sides collinear. The paper shows that the resistance between two transverse sections through points situated at considerable distance from the change of section on opposite sides of it is equal to the sum of the resistances of the portions of conductor between each of the two sections and the change of section, each considered as part of an infinite length, plus the resistance of a length of either conductor equal to its breadth multiplied by an expression given.

Dr. Russell congratulated the author on having obtained the exact solution of an important problem and thanked him for giving it in a form in which it could be utilized readily by electricians. Somewhat similar problems were of frequent occurrence in practice, in particular he instanced the measurement of the resistance of the bonds connecting the rails in electric tramway systems. The difficulty in this case was in knowing where the rail ended and the bond began. A small variation in the position of the potential contacts made a large variation in the reading of the galvanometer. In many cases the only way of attacking the problem was to calculate the resistance from the known resistivity of the metals by the approximate method indicated by Maxwell. An exact solution, therefore, like the one obtained by the author, would be of great value in checking the accuracy of the approximate method.

ELECTRICAL MACHINERY IN A GREAT CORN PRODUCTS PLANT.

BY C. A. TUPPER.

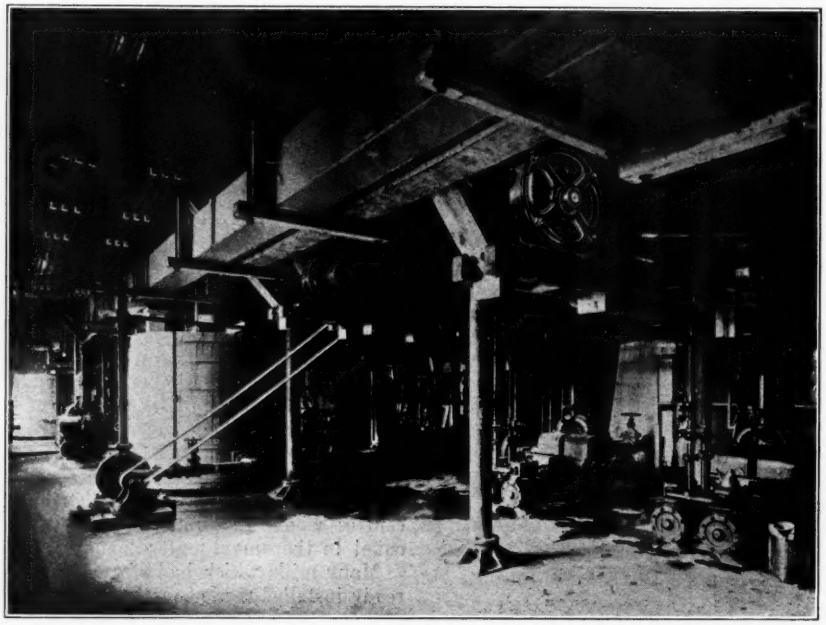
One of the most recent of the few great plants devoted to the processing of corn products is the American Maize Products Company, of Roby, Ind. There are not many plants devoted to this industry, owing to their great size and first cost. The corn, before it is available for food or industrial purposes, must pass through a great many operations of weighing, steaming, crushing, grinding, sieving, separating and packaging. In all of these operations the electric drive plays an important part. In this plant, alternating-current motors of the induction type, built by the Allis-Chalmers Company, Milwaukee, Wis., have been used. Most of these are of standard construction, but the motors connected to the buhrstone mills, for grinding the corn very fine, are special machines, having been developed for this purpose. The applications of these motors are well shown in the accompanying illustration. Each is of the vertical belted type designed for operation on sixty cycles, and has a normal rated output of seventy-five horse-power. The stator core is supported in a cast-iron housing provided with projecting lugs that rest on the slide rails. The stator core shows open slots that allow the coils to be readily removed in case repairs are necessary. The stator has a fourteen-pole winding, thus giving a synchronous speed of 514 revolutions per minute, the full-load speed being approximately 490 revolutions per minute.

The rotor spider is mounted on a vertical shaft which passes through a guide bearing at the top of the motor. A second guide bearing is placed at the bottom, and the weight of the rotating part is carried by a multiple-disc, self-aligning thrust-bearing under the lower end of the shaft. A complete oiling system is provided whereby oil is supplied to the upper bearing from a large sight-feed oil cup and, after passing through this bearing, flows to the lower one. The thrust-bearing is designed so that all parts are thoroughly lubricated. The pulley is at the top of the motor, and the vertical arrangement allows the motor to be belted directly to the mill without the use of a quarter-turn belt.

In addition to the buhr mills the elevators, conveyers, shaking sieves, and, in fact, all of the moving machinery, are driven by motors of capacities ranging from five to thirty horse-power.

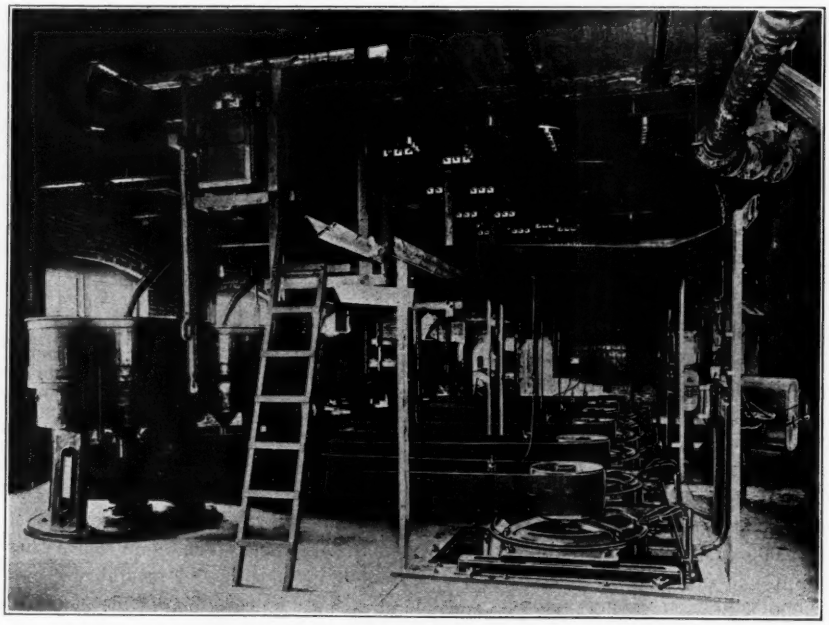
Not the least important part of this great plant is the pumping machinery, which consists of the following units supplied by the Platt Iron Works, Dayton, Ohio:

Two twelve and eighteen by fourteen by eighteen-inch duplex pumping engines of the outside centre-packed plunger type, each having a capacity of 1,400 gallons of water per minute. Three single-stage centrifugal pumps for the steeps, each having a capacity of 200 gallons per minute. These pumps are placed on extended bases and direct connected to seven-and-one-half-horse-power motors. The shaft coming in contact with the liquor is made of bronze composition. One single-stage centrifugal pump for the shakers, having a capacity of 400 gallons per minute. This is direct connected to a fifteen-horse-power motor.



INDUCTION MOTORS FOR DRIVING PUMPS AND SPECIAL MACHINES IN GLUCOSE FACTORY.

One single-stage centrifugal pump for discharging slop from the buhr mills, having a capacity of 400 gallons per minute. The pump is placed on an extended base and direct connected to a seventeen-and-one-half-horse-power motor. Four



SEVENTY-FIVE-HORSE-POWER VERTICAL INDUCTION MOTORS BELTED TO BUHR MILLS IN PLANT OF AMERICAN MAIZE PRODUCTS COMPANY, ROBY, IND.

single-stage centrifugal pumps for crushed corn, each direct connected to a fifteen-horse-power motor. One single-stage centrifugal pump for the starch-breaker, having a capacity of 400 gallons per minute, direct-connected to a fifteen-horse-power motor. One single-stage centrifugal pump for water, having a capacity of 700 gallons per minute, direct-connected to a twenty-two-horse-power motor.

The centrifugal pumps are of the balanced type, with single suction opening. The casing is circular and concentric, fitted with discharge flange, and with feet for bolting to the foundation. The suction is on the drawing side and admits the water to that side of the casing. It passes through cores in the chute case to the front end of the impeller, so that the impeller has suction on each side and is consequently balanced.

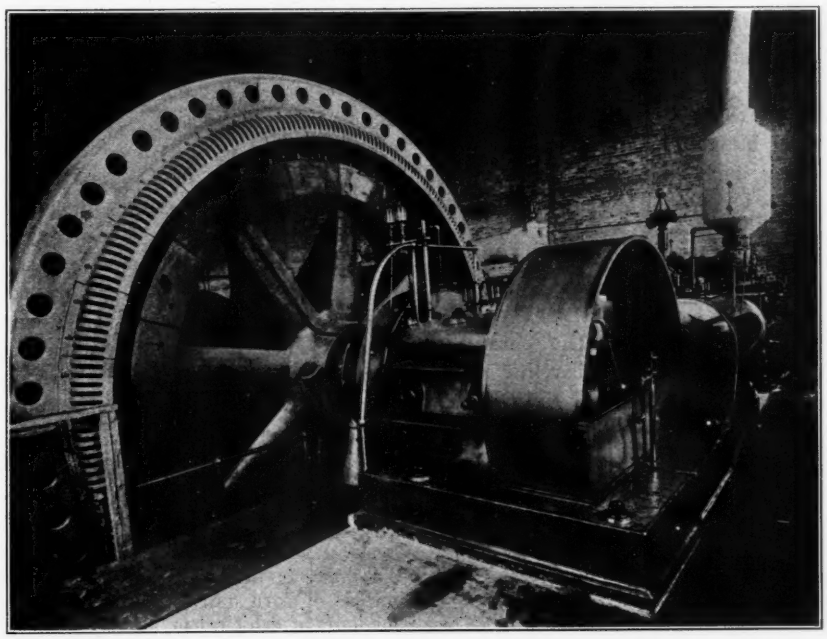
Two eight and eight by ten-inch duplex pumps and two ten and ten by ten-inch duplex pumps, with plain slide-valve steam cylinders and piston-packed water boxes for operating under a liquid pressure of fifty pounds, with an available steam pressure of 130 pounds.

Six eight and six by ten-inch duplex yoke-type pumps for the refinery. Two twelve and eight by twelve-inch duplex outside centre-packed plunger boiler-feed pumps, equipped with chilled-iron plungers, brass-covered plunger rods and brass-bushed plunger glands and boxes.

Two ten and sixteen by ten-inch duplex crank and flywheel vacuum pumps, provided with automatic governors.

One ten and ten by twelve-inch duplex clapper-valve pump, with slide-valve steam end, and brass-fitted clapper-valve liquid end.

The power plant has been designed in strict accordance with latest practice and possesses many features of special merit. In the engine room there is but one large main unit, which is a twenty-six and fourty-four by forty-eight-inch Allis-Chalmers cross-compound Corliss engine, connected to an alternator of the same company's build and having a normal rating of 800 kilowatts. The generator is a three-phase sixty-cycle machine of the revolving-field type and was designed to deliver 480 volts' pressure at a speed of ninety revolutions per minute. The rotor of the generator is about seventeen feet in diameter and weighs seventeen tons. The load carried by this machine is mostly power, consisting of 150 motors and ranging in capacities from five to seventy-five horse-power. There is, of course, a sufficient number of incandescents to light the plant. The lights are carried on three-phase feeders and as nearly as possible are distributed equally between the phases. From four to six hours a day the large unit is run on twenty-five per cent overload and apparently carries it with the greatest of ease.



800-KILOWATT, ENGINE-DRIVEN ALTERNATOR IN PLANT OF AMERICAN MAIZE PRODUCTS COMPANY, ROBY, IND.

Besides the large unit there is a smaller direct-connected set consisting of a fourteen by fourteen-inch Chandler & Taylor engine and a three-phase Allis-Chalmers revolving-field generator. To this set is also belted a thirty-five-kilowatt direct-current exciter. The small set is used only at night or any time when there is a very small load to carry. When starting up the larger unit it is also used for exciting current, the three-phase alternating-current being transformed to direct current by means of a fifty-kilowatt motor-generator set. The belted exciter may also be used, so that there are at least two sources of excitation. When the large machine is running exciting current is obtained from the motor-generator set, the synchronous motor receiving current from the main generating unit.

For control of the electrical apparatus and distribution of the load the station has a seven-panel switchboard, which was installed by Kohler Brothers, of Chicago. The board is equipped with a full line of instruments, consisting of ammeters and voltmeters of Wagner make, Westinghouse integrating and recording wattmeters, a Westinghouse synchroscope and power-factor indicator. Condit three-pole circuit-breakers are installed and Cutler-Hammer chain-operated field rheostats.

In the same room, but at a lower level than the power-plant floor, are some of the pumps previously mentioned, that is, the two pumping engines for water supply, the two boiler-feed pumps and the two Underwriter fire pumps. In addition to the pumps are two Stilwell feed-water heaters, with space for a third, and also an air-compressor to furnish the shop with a supply of compressed air for pneumatic tools, etc.

On account of the large demand for steam throughout the plant there are six Aultman & Taylor boilers installed, each rated at 440 horse-power, set singly and each having 4,403 square feet of heating surface. The boilers carry a pressure of 150 pounds per square inch, and five of them are in constant operation, with one down for cleaning or repairs. They are equipped with chain-grate stokers of the Mansfield type and are run with natural draft supplied by a radial brick stack built by the Heine Chimney Company, of Chicago. The stack is 200 feet high from the boiler-room floor, which is six feet above grade, ten feet in diameter all the way up and has a radial brick lining for sixty feet of its height. It is located right in the boiler room, midway between the two middle boilers, and has a flue opening on either side with a six-inch baffle wall in the middle to prevent interference of draft. For a brick stack the location is unusual and a peculiar feature is the passageways under the stack. These are at right angles to each other and are on

a level with the boiler-room floor. A cable is drawn around the top of the chimney and is provided with four points, each having a twelve-inch platinum tip. Two ground connections are provided and the cables are secured to the chimney by means of bronze anchor fastenings.

Special care was taken in the design of the breeching, which was built up of brick and covered with reinforced concrete. As above indicated, there are three boilers on each side of the stack, so that there are three boilers discharging their gases into each breeching. On this account the area at the entrance to the stack was made equal to three times the area of the outlet from the boiler, twice as large between the second and third boilers and at the first boiler of the same size as the outlet. This arrangement gives each boiler an equal draft and prevents any choking of the gases in its passage to the stack.

Feed water for the boilers is taken from Wolf Lake, which is only a few feet from the plant. The water in this small lake is unusually muddy, and it was necessary to install a filtration plant for its purification. The National Filter Company, of Chicago, erected the plant.

For the supply of the entire works the water is drawn from the filtration plant through a twelve-inch pipe by one of the pumping engines previously mentioned. To this main supply a four-inch tap is made for boiler feed, and before reaching the boilers the water is passed through the Stilwell feed-water heaters, which are twelve feet nine inches high and sixty-six inches in diameter. The heaters raise the water to a temperature of 200 degrees Fahrenheit. But little cold water is required, however, as the condensation from traps and exhaust is usually sufficient.

To collect the ashes, each boiler is provided with an ash hopper, from which the ashes are taken in small dump cars. These cars are pulled mechanically outside of the building and the ashes are dumped on the premises and used for filling purposes.

As the coal used in the stokers contains considerable dust after passing through the crushing machine, there is a good deal of fine material which will drop through the chain grates, and in a great many cases is entirely wasted. In the plant under description, however, each hopper is provided with a plate to divert the fine coal dropping through in this manner. Provision is now being made to convey this fine coal to the elevator and eventually return it to the stokers.

Two steam headers have been provided: the main header, which is sixteen inches in diameter, and an auxiliary header, eight inches in diameter. With the piping arrangement it is possible to utilize either header and cut out, if necessary, either half of the main header for repairs. From one to the full number of boilers can be turned onto the headers as desired, and there is no danger of any pumping back and forth between the boilers from unequal pressures, as each leader is equipped with an automatic stop valve.

Live steam is used to some extent in the plant, especially for the fan engines, steam dryers and pumps, in connection with the drying rooms. Most of the steam, however, used for the various processes is exhaust from the engine units and the pumps. For this reason condensers are not installed. This supply of exhaust steam is collected in a large eighteen and twenty-inch pipe, and at infrequent intervals, when the steam is not all required in the plant, it is exhausted to atmosphere.

Of the entire boiler room, the feature of chief interest is undoubtedly the coal-handling apparatus. This is unusually complete for a plant employing only six boilers.

A receiving conveyer has been placed parallel with the track on which the coal arrives, being between the track and the wall of the boiler house. The conveyer is provided with a hinged shoveling apron placed at an angle of about sixty degrees between it and the side of the car. To this apron the coal is shoveled and flows down on the conveyer, and is carried forward and discharged to a standard boiler-house crusher, operated by a thirty-horse-power Allis-Chalmers motor, by which mine-run size is reduced to one-and-one-half-inch maximum cubes.

The hopper that receives the crushed coal is connected by a chute to a continuous bucket elevator, which raises the coal and transfers it to a flight conveyer extending through the boiler house over bunkers. It is then delivered by the conveyer through gates placed in the trough to such bunkers as it may be desired to fill.

When handling mine-run, the capacity of the installation is governed by the maximum capacity of the crusher, which is from forty to fifty tons per hour. When handling fine coal not requiring crushing, the capacity is controlled by the elevator, namely, from fiftv to sixty tons per hour. The system is electrically driven throughout with controlling mechanism located inside the boiler house. It was installed by the Link Belt Company, of Chicago.

In an installation of this kind, with the coal hoppers above the boilers and feeding the coal through chutes to the stoker, difficulty is always experienced in opening or closing the gates controlling the supply of coal, as they are very apt to wedge or become stuck in some way. To prevent this and get a straight pull or push on the gate, a bell crank-and-screw arrangement was provided. The screw has only five threads to the inch, so that a few turns of the wheel will open or close the gate.

Another feature of interest is the poke rod. This is provided with a ball which will close the opening through which it passes and at the same time allow a thrust in any direction to start the coal if it happens to become lodged at the mouth of the hopper.

The power-house, corn-storage tanks and manufacturing buildings are of fireproof construction, and the warehouses are of mill construction. All buildings are so arranged as to have excellent light and ventilation, and the floors of the fireproof buildings are arranged to be flushed with water at the close of each day, so as to have them at all times in a state of cleanliness and perfect sanitary condition. A complete sprinkler system is installed, and with a 50,000-gallon water tower in connection with the two fire pumps a pressure of 200 pounds is maintained all over the grounds.

This plant, which was planned and constructed under the supervision of its superintendent, P. L. Saenger, assisted by G. C. Welch, S. H. Lanyon and J. J. Waechter, is designed to handle 30,000 bushels of corn daily, the machinery for one-half of which has already been installed. In completeness and economical operation it leaves practically nothing to be desired, and the large demand for cornstarch and syrups now existing throughout the country insures a good market both for its products and those of the company's predecessors in this particular field.

Michigan Telephone Returns.

In its application to the New York Stock Exchange for the listing of additional common stock the Michigan State Telephone Company gives the following statement of income for the four months ended April 30 last: Receipts, $1,084,182; total expenses, $807,936; net earnings, $276,246; interest, $134,433; balance for dividends, $141,813; dividends on preferred stock, $45,664; surplus, $96,149.

THE ADVANTAGES OF MEMBERSHIP IN THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

BY CHARLES B. BURLEIGH.

The question has frequently been asked, What advantage is to be derived from membership in the American Institute of Electrical Engineers?

There can be no question as to the duty of every American citizen to support and maintain the Supreme Court of the United States. Can there, therefore, be advanced any legitimate reason as to why it is not a duty that he owes, not only to himself but to each and every one of his associates in the business in which he is engaged, for every electrical engineer to do his utmost to support and maintain a court of last resort, by whom all disputed technical questions in electrical engineering shall be finally settled; to assist so far as in him lies, in removing all electrical work from the region of guesswork to that of certainty, thereby increasing the stimulus to the successful investment of capital in electrical enterprises; to effect a concentration of effort and increased mentality excited by generous rivalry?

With these objects in view the American Institute was formed with the avowed purpose of "promoting the arts and sciences connected with the production and utilization of electricity and the welfare of those employed in these industries; by means of meetings for social intercourse, the reading and discussion of professional papers, and the circulation, by means of publications among its members and associates, of information thus obtained."

Appreciating this situation, affiliation with the organization is not a question of what benefit will result to the individual but is a duty he owes to the art, to his associates and to himself, to do everything in his power to aid and assist in the support and maintenance of an institution without which we would all be whirling around in our own little circle, duplicating effort, narrowing the scope of the art and our own fields of usefulness.

The electrical engineer also owes a duty to the public in general, who place in his hands the solving of problems in connection with the details of which they are totally uninformed, and only by placing himself in a position to give them the best information procurable can he be assured of rendering to them full return for the confidence imposed. Again, it is generally conceded by the world at large that the most valuable opinion and judgment on any class of work is that rendered by the leaders in that profession; for which reason the electrical engineer's standing is in a great measure fixed by the recognition of his ability by his associates, and only by an acquaintance with them, thus offering them the opportunity to familiarize themselves with his capabilities, can he establish his standing, and as the best estimate of an engineer as a man and an engineer is the opinion of the members of his own profession, it is his duty to himself, as well as to those from whom he derives his livelihood, that he become known to and acquainted with his associates.

Association with the leading organization connected with the business, composed of men who are recognized by their associates as masters of their profession, offers the most available opportunity for this acquaintance and as rubbing against the smutted kettle will besmirch, so will close contact with the bright tend toward polish mentally as well as physically.

The benefits to be derived from this association depend largely upon the individual to the extent that if he joins the organization, prompted only by selfish motives, to receive and not to impart benefit, he will receive but little, while he who connects himself with the association, hoping by his work to promote its success, receives in return inestimable benefit from the fact that his work and his contributions tend to make him known to his associates and establish his standing not only among them but in the field at large.

Again, in connection with the different matters brought before the organization for its consideration, he either attends the meeting at which they are presented or reads of them in the transactions, and as reading any similar article presented through the usual channels, forms his own opinions on the subjects treated, but his connection with this association offers him the opportunity to familiarize himself with the opinions of his associates on the subject, and by discussing their opinions, either with them or with himself, arrives at a much broader understanding of the matter.

As the association aims to take up and discuss in its earlier stages of development any and all improvements in the art, the facilities offered enable the membership to keep just a little ahead of the non-members and the public, and prepares them to pass judgment on new devices as soon as their practical consideration becomes desirable.

The scope of the art is continually broadening to such an extent that the necessity for specialization is becoming more and more apparent. The closer the lines are drawn in this direction the more important becomes an organization which offers us the facilities for keeping in touch with the whole general situation, and the more good work can the specialist do for the organization and through it for the art.

Having been connected with the electrical business for some thirty years and with the Institute seventeen years, I feel that I may be pardoned for a suggestion to the older members and a word of advice to the younger members of the profession.

To the older members I would say:

You have seen our profession grow in the last thirty years from the electrician who could set up and connect the gravity cell for the operation of the key and sounder to the electrical engineer who can carry on his shoulders the water and steam power of the world and deliver its useful energy at any point where commercial conditions make its utilization desirable, outstripping by leaps and bounds all other engineering professions.

I may have contributed individually no more than you to this marvelous development, but the association of which I am a member is in a great measure responsible for it, for which reason you owe to it in a large measure the benefit you have and are receiving from it. You would be ashamed to be accused of not paying your just debts. Here is one long overdue, and the quicker you settle by adding your assistance to the good work in becoming a member the sooner you can look everybody in the face and say, "I am in part responsible for the results attained."

To the neophyte I would say:

In any line, individual effort is always praiseworthy, but team work presents the shortest route to success.

The sooner you connect yourself with the Institute the quicker you will begin to obtain the best returns from the energy you expend in promoting the interests of the profession you have entered, to the benefit of your employer and to yourself, and if you remain in the business you can look back with pride, in the years to come, to the fact that you have always, from the first moment of entering the profession, lent your best efforts to the best advantage to the advancement of the art.

You may feel that you have completed your education and are now about to reap the benefits. Allow me to disabuse your mind of this idea. Your education has just commenced. Your school and college have provided you with an excellent outfit of tools and you are now about to be taught how to use them to the best advantage.

The art is progressing and you will find that new adaptations require new tools not in your chest and membership in the Institute will tend to keep your tool chest up to date.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

The Spectrum of Radium Emanation.

Having secured a preparation containing about 250 milligrammes of radium, E. Rutherford and T. Royds seized the opportunity thus offered to study the spectrum of the emanation given off by this preparation. It was found that the minimum volume of the emanation per gramme of radium was not in accordance with that to be expected from calculation. This emanation was condensed by liquid air in an exhausted tube of about fifty cubic millimetres capacity, provided with thin platinum electrodes. Two photographs were taken immediately, one of which shows about thirty intense lines and the second more than one hundred lines. The color of the discharge in the tube was bluish. Visible observation was also made. When the emanation was condensed in a side tube by means of liquid air the character of the emanation of the lines vanished. The color of the discharge changed completely and became a pale rose. At the instant of volatilization the emanation lines flashed out again. The hydrogen lines were visible in the spectrum and became more brilliant when the emanation was condensed. These lines were not observed in previous experiments where an electrodeless discharge took place and they were probably due to hydrogen given off by the platinum electrodes. It was noticed that the amount of pure emanation in the tube gradually diminished with the increase of the time of the discharge. The spectrum, however, persisted until all of the emanation had been driven into the walls of the tube. The wave-lengths of the lines of the plate were accurately measured, the results agreed fairly well with the determination made by Ramsey and Collie in 1904. —*Abstracted from Nature (London), July* 9.

Apparatus for Checking the Adjustment of Automatic Oil-Break Switches.

It is very desirable that some means should be provided for enabling the adjustment of automatic oil-break switches to be checked quickly from time to time. These switches are operated automatically by means of trip-coils which are excited from a source of continuous current or alternating current. When direct-current tripping-coils are used it is an easy matter to test them to see if they are in order. In fact, it is common practice to arrange a push button for the contacts of the controlling relay, thus exciting the trip-coil and operating the switches. But when alternating-current trip-coils are used it is not so easy to test them. Such coils are fed very often directly from the secondary of a current transformer without an intermediary controlling relay. There is not sufficient current to operate the relay passing through the trip-coil until there is an overload. Under ordinary circumstances it is not possible, without making special arrangements, to get sufficient current through the trip-coil to cause it to operate. A means of doing this has been devised by C. C. Gerrard. For this purpose an adjustable choke-coil is used. It may be fed from a source of low-tension alternating current of, say, 200 volts. By means of an adjustable core a secondary current may be obtained within fairly wide limits. The apparatus is used as follows: about once a month the current transformer is short-circuited and disconnected from the trip-coil. The latter is then connected by means of a core through the choke-coil to a low-tension circuit. By varying the adjustment of the core it is easy to determine the current required to open the switches.—*Abstracted from Electrical Engineering (London), July* 3.

The Oscillatory Character of Lightning.

A brief review is given here of a paper read recently by Dr. Bernbach before the German Technical Association, in which the author discusses the character of lightning. He argued, on the whole, against the oscillatory character of lightning discharges. Theoretically a discharge should be oscillatory when the resistance term of the impedance is less than the reactance term. As the resistance of air is very great and the capacity is likewise great, while the self-induction is probably small, it is hardly probable that the second term of the impedance should become larger than the first; the value will, therefore, remain positive and oscillatory discharges should not be expected. Dr. Bernbach contended that photographs of lightning flashes do not show any such oscillations. Such photographs sometimes show a number of successive discharge pulses, following about the same path. The second flash path being longer than the first. The ramifications of a light discharge do not mark any change of polarity and when photographs show bright spots, it is probable that these portions of the discharge appear brighter because the direction of this part of the path is more or less toward the camera. The well-known Leyden jar experiments of Lodge illustrating the peculiar, apparently capricious, deviations of the spark from its natural path do not necessarily demonstrate any oscillations in the currents. The resistance effect of conductors must be taken into consideration not only with high-frequency currents, but with very intense direct-current discharges at a very rapid rate. Although the inductance may be small the rate of change of current may be large and there is trustworthy evidence of lightning currents of more than 20,000 amperes, the time limit being about one minute.—*Abstracted from Engineering (London), July* 10.

A New Development in Cross-section Paper.

A method of using cross-section paper is described here by Henry Hess, which enables the user to deduce easily the equations for any curves of the first or second degree. Two kinds of paper are used, that usually called cross-section, or more properly co-ordinate paper, in which the divisions are uniformly spaced and that in which the ruling follows a logarithmic scale. The first kind is suitable for curves of the first degree. The usual scales, running, say, from one to ten and starting at the lower left-hand corner, are marked off and in addition two other scales are added, in this case running from zero to one, in tenths and starting at the lower right-hand corner for the scale of ordinates and at the upper right-hand corner for the scale of abscissas. The usual scales are employed when plotting the curves. The additional scales are used for finding the constants and exponents of the variables. The method

consists in plotting a secondary curve parallel to the primary curve, or making the same angle with the axes, and passing through the origin. The secondary line gives the value of y in the equation $a = yb \pm z$. While the value z is given by the distance of the intercept of the curve from the axis of ordinates, the slope of the curve determines the signs of the different terms. The method of employing the logarithmic paper is the same, except that this is used when the curve is not of the first degree. The general equation being $a = yb^n + z$. The advantage of the logarithmic paper is that the equations then may give straight lines and the intercept of these lines with the new scale at the top or right gives at once the exponent of the second term of the equation. When a constant term enters into the equation the curve plotted on logarithmic paper is no longer a straight line, but a secondary curve of the former, which will be a straight line, is easily plotted. The author shows how the equations most encountered in engineering work are easily deduced without it being necessary to apply the tedious algebraic process.—*Abstracted from the Proceedings of the Engineers' Club of Philadelphia, Philadelphia, April.*

Flywheels or Storage Batteries for Equalizing Fluctuating Loads.

Flywheel storage systems have recently been coming extensively into use for taking up fluctuations of loads, especially in connection with mining work. This arrangement is thought by G. C. Allingham to be best adapted to equalizing the power demand of an individual machine which goes through a definite cycle of operations —which is repeated so that very short periods of heavy and light loads recur alternately in regular succession. In such cases the actual amount of energy that is to be stored is small, although the power to be dealt with is large and this energy must be stored for but a short time. For such arrangements it is possible to work the flywheel equalizer at a comparatively low factor. On the other hand, where the loads are irregular in frequency and amount, and where they last for longer periods or occur in rapid succession and may also be separated at times by comparatively long periods of light load, the flywheel equalizer is not suitable on account of the small amount of energy it is capable of storing and its heavy no-load running losses. In such cases the load-factor of the equalizing plant is of necessity low and the constant running loss being high the work efficiency must consequently be low. Haulage gear is an instance of a machine whose load curve is usually extremely irregular and for which flywheel storage would therefore not be well adapted; a coal cutter is another instance. The alternative to flywheel storage is the use of a storage battery in combination with an automatic reversible booster. This is more expensive than the flywheel, but it has the advantage of being able to store sufficient energy to deal with any combinations of peaks and depressions in the load curve that can possibly occur. Its no-load running loss is insignificant and the working efficiency is almost independent of the load factor. It has the additional advantage of acting as a reserve in case of a breakdown or of an unusually heavy load on the generating plant, making it possible to shut down the generating plant entirely at times of light load. There are now systems adapted to equalize the loads on alternating-current circuits, so that the battery can, without difficulty, be applied in just such cases as lead to development of the flywheel storage system.—*Abstracted from the Electrician (London), July 10.*

The Equipment of Farms and Country Houses with Electricity.

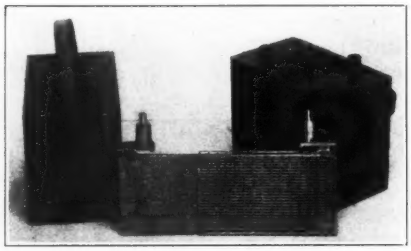
A machine which may be substituted for manual labor should be of great value to the land owner to-day because of the difficulty of obtaining satisfactory farm-hands. In this article Putnam A. Bates contends that this want is largely supplied by the electric motor and that the latter may be expected to relieve the farmer or dairy man of much of the hard work connected with his business. One difficulty which retards the rapid introduction of the motor for this purpose is the high cost of energy in rural districts so that some means of reducing the expense of running motors seems necessary. In the last few years the small internal-combustion engine and the storage battery for stationary service have been so much improved and simplified as to cause them to compare favorably with the better-known types of power-producing apparatus in reliability of operation and first cost. The simplicity of this engine and of the storage battery, together with the economy of fuel consumption of the engine and the efficiency of the battery as a device for storing energy and delivering it when needed and in the quantity required, results in a low operating cost. Still another promising source of power for such small plants is the small water powers scattered throughout the country, many of which have been already developed but abandoned for mill purposes because it was found to be impossible to compete with larger mills. It is evident, therefore, that those not reached by reliable and low-priced electric service may still avail themselves of the electric current and obtain the many conveniences which it contributes, at a cost which should seldom exceed that of an equivalent service from a public-service electric plant. This, of course, will depend upon the design of such small isolated plants. Suitability to the requirements is more important in such plants than in larger ones where the load is more elastic and may be controlled to a considerable extent. Many small power plants have been abandoned as unsatisfactory and extravagant after a short period of operation or are being run at excessive cost with little satisfaction, for no other reason than that the apparatus installed is not well suited to the load. For this reason it is inadvisable to decide the question in an offhand way and leave the installation of the equipment to the contractor since, no matter how honest the latter may be, he is seldom capable of giving the little plant the engineering consideration which it should have. Frequently it is said that the cost of lighting by electricity, in spite of its cleanliness and convenience, is too great when compared with gas, but if the incidental expenses resulting from the use of gas are included in the estimates, it would not infrequently be found that the electric system is, on the whole, considerably cheaper. On the farm there is the greatest opportunity for a successful application of electricity, because in addition to the lighting which, if undertaken alone might not be successful, there are many opportunities for using the small electric motor. The author has himself been engaged in work of this kind for several years past and is convinced that electric power may often be applied profitably to such work. To illustrate his point he describes several installations, some of them on farms and in dairies and one of them at a large country home. Each case shows a surprising number of uses of the motor. The best arrangement is a gas or oil engine driving a generator charging a storage battery. The latter should be large enough to supply the lighting at night and light loads during the day. Such an equipment is not expensive and requires but little attention and that not of an experienced kind.—*Abstracted from the Journal of the Franklin Institute, Philadelphia, July.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Universal Electric Storage Battery.

The Universal Electric Storage Battery Company, 65 North Peoria street, Chicago, Ill., has developed an ignition battery in which especial attention has been paid to overcoming the mechanical defects which exist in so many types. This battery is sealed, so that the corrosive acid can not spill nor slop over even if the battery is violently shaken, the sealing compound being an especially strong, smooth and adherent mixture of the company's own discovery. The hardwood box protects the rubber jar containing the element from breakage from sudden shocks. The terminal posts are strong and entirely non-corrodible, being made of alloy and hard rubber, both of which are unaffected by acid.



"Universal" Electric Storage Battery.

The electrodes are of the most modern type, and very carefully constructed.

The standard six-volt, sixty-ampere-hour size is suited not only for ignition, but for all sorts of medical and surgical use, for running phonographs, exploding blasts, and lighting miniature lamps.

The New Helios Ignition Battery.

The Helios Manufacturing Company, Bridesburg, Philadelphia, Pa., has placed on the market a new ignition battery which is being received with a great deal of satisfaction by contractors in general. Quite a business is being built up furnishing these ignition batteries for automobile service and selling them in conjunction with small lighting units and for the operation of electrical toys, electrical pianos and other light work. The Helios battery consists of very few parts, and the company is able to produce the battery at a low cost.

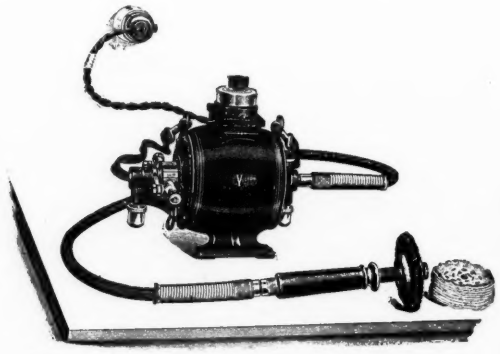
The battery is equipped with a new type of rubber case, so constructed that it is strong enough to be used without any auxiliary support. It is supplied with soft-rubber rests and a guard band, relieving the battery from sudden jars in rough handling. It is furnished with terminals of an improved type that can not become loose nor affected by the acid fumes. It is built in the following capacities: Four volts, thirty ampere-hours, twelve pounds; six volts, thirty ampere-hours, seventeen pounds; four volts, sixty ampere-hours, seventeen and one-half pounds; six volts, sixty ampere-hours, twenty-six pounds; four volts, eighty amper-hours, twenty-three pounds; six volts, eighty ampere-hours, thirty-three pounds.

Apple Six-Volt, Sixty-Ampere Storage Battery.

The Victor Portable Polishing Outfit and Air-Compressor.

The Victor Electric Company, 55-61 Market street, Chicago, Ill., is the manufacturer of two electrical devices which meet many of the requirements of the contractor for shop and factory use and for executing orders in connection with the wiring and fitting up of residence installations. The Victor portable polishing outfit is neat and powerful, is used principally for cleaning and polishing, and is portable enough to be carried anywhere. It can even be swung from the back of the operator, carried on a carrying strap and belt. The flexible motor shaft enables the operator to reach everything within a number of feet of the motor, and a ten-foot cord attached to the nearest electric socket gives a wide radius of operation. With this outfit metal fixtures, signs, railing and parts of machinery can be easily cleaned and polished in a small fraction of the time necessary to do it properly by hand.

The motor develops one-eighth horsepower, and the entire outfit weighs less than twenty pounds. The buffer and brushes can be easily and quickly changed.



The Victor Portable Polishing Outfit.

The air-compressor was designed to meet the demand for an outfit capable of supplying a moderately large volume of compressed air at a pressure up to seventy-five pounds. It is supplied with two pistons having two-inch bore by two-and-one-half-inch stroke, and can be safely operated at a speed of 275 revolutions per

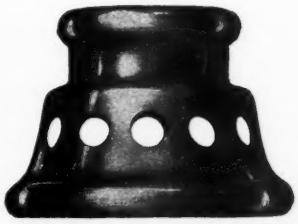
The Victor Air-Compressor.

minute. The motor furnished with the direct-current outfit is capable of developing one-half horse-power, and the winding is calculated especially for this work.

The company manufactures several other types of air-compressors, particularly for dentists and physicians. The company also manufactures the compressor just described mounted on a truck with a pressure regulator and reservoir.

Some Dale Designs for Tungsten Lamps.

The Dale Company, Ninth avenue and Hudson street, New York city, has been at work for some time developing a line of fixtures adaptable to the use of the new high-efficiency lamps, and has produced several specialties adapted to take tungsten lamps. Particular attention is called to the new style shade-holder and adapter illustrated herewith. No adjustment of any kind is necessary with this two-and-one-quarter-inch holder, which goes on the socket easily and firmly and holds the shade rigidly.



NEW STYLE DALE HOLDER.

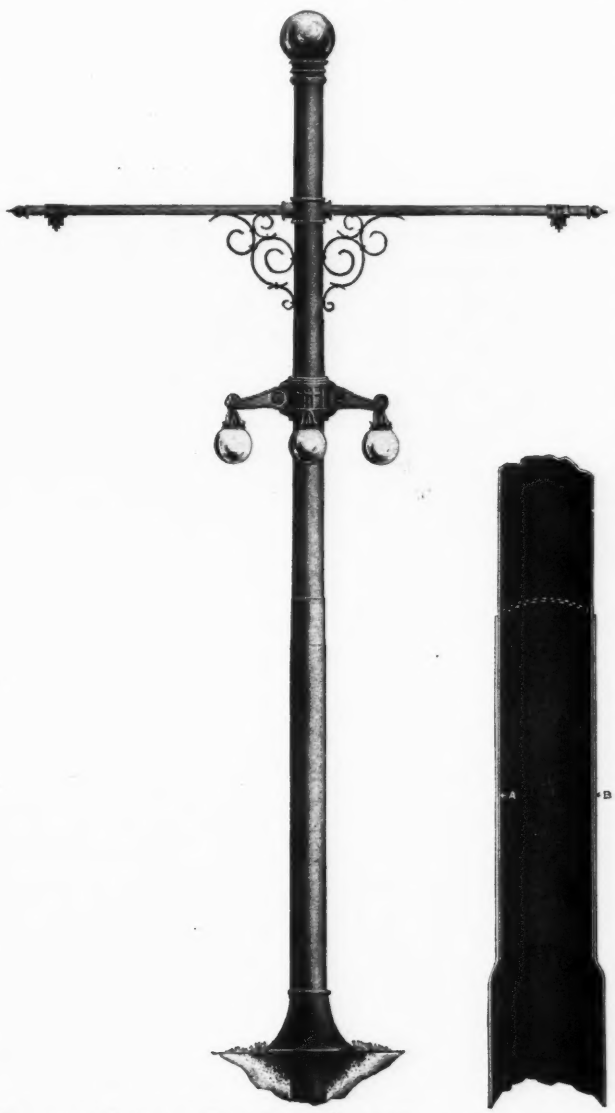
NEW DALE TUNGSTEN ADAPTER.

The adapter for tungsten lamps is a simple device which can be used in clusters or fixtures where lamps are at an angle, making it unnecessary to reconstruct or rewire the fixture.

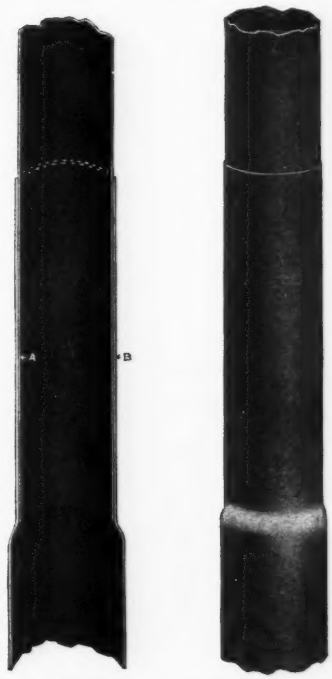
These devices have met with instant success and are being used by central stations, electrical contractors, jobbers and supply men all over the country. But devices are labor and money-savers and increase materially the opportunities for the use of electricity.

Tubular Steel and Iron Poles.

The Pittsburgh Pole and Forge Company, Pittsburg, Pa., is the manufacturer of steel poles and forgings of every description. The company is introducing a line of tubular iron poles, trolley poles, rail benders and car forgings. The accompanying illustrations show the style of pole made by this company, attention being particularly directed to the form of joint used. The tubular steel or iron pole for light and power plants has many advantages. The obstacle preventing the use of tubular iron poles for high-tension transmission work has been overcome by the Pittsburgh Pole and Forge Company by its patent hot process of making a solid swaged joint of the same diameter and thickness for the entire length of joint. It is impossible to telescope the pole either by overload or drop test. Under hydraulic pressure the pole will bend before the joint will give way. It is also stated that this joint is proof against corrosion by water.



PITTSBURGH STANDARD COMBINATION SPAN AND LIGHT POLE.



PITTSBURGH SOLID-JOINT TUBULAR POLE.

Magnalium.

Magnalium is an aluminum alloy which promises to fulfil many of the expectations which have been based in the past on the utilization of aluminum. Magnalium can be cast in a liquid condition, and the castings machined with about the same facility as brass. The machined surfaces are mirror like and of a silvery color. Screw threads can be easily and perfectly cut, and bored holes are always sharp and clean. The metal does not clog even a very fine file.

When magnalium is cast in dry sand it usually has a tensile strength of 18,000 to 21,000 pounds per square inch, and shows a reduction area of three and one-quarter per cent. Cast in an iron chill, it has a tensile strength of 22,000 to 25,000 pounds per square inch, with a reduction of area of five per cent to eight per cent. The tensile strength of one quality of magnalium containing a somewhat smaller percentage of aluminum

equals about 34,000 pounds per square inch. This can be increased to about 42,500 pounds per square inch by proper treatment.

Wire drawn from one quality of this alloy has a tensile strength of 41,000 pounds per square inch, with a reduction area of ten per cent. It will stand a tensile strain of 53,000 pounds if the raw material has been forged before drawing.

Magnalium shows almost no magnetic influences, but its electrical conductivity is about fifty-six per cent of that of pure copper.

Morris R. Machol, 32 Park Place, New York city, is the American agent for the magnalium process.

Electrical Equipment of the Southern Lumber Company's Plant at Bogalusa, La.

One of the most important electrical installations of recent times is that recently completed by the Great Southern Lumber Company, at Bogalusa, La. The importance arises not only from the fact that this is the first installation of this kind in that section of the country, but because it is the largest electrically equipped wood-working plant in the world.

The enormous capacity of this plant has made it necessary to cover a large area, consequently considerable of the wood-working machinery is located at such a distance from the main sawmill that the transmission of power would be almost impracticable through any other means than by the application of electric motors.

A practical mill man will readily understand that there are a large number of complications required where rope transmission is used and that such a system only multiplies the use of belts, pulleys, hangers, etc., as well as adds to the cost of help necessary to keep such apparatus in working order.

The electric drive, when properly installed, does away with long lines of shafting and multitudes of hangers, journal boxes, etc., which have to be continually looked after and kept in repair. It further does away with a great number of expensive belts, which frequently break and have to be renewed or retightened owing to various conditions which must be anticipated.

It is not possible to eliminate all belting in a wood-working plant where electric motors are used as, for example, the small machines in the filing room which may be grouped so that several operate from one motor, or the lumber sorters, blowers and stackers may require short lengths of belting, but even in this case long lines of shafting and gearing may be eliminated. The excellent arrangement and consequent economy of operation of this plant, secured by direct drive, is in a great part due to the efforts of G. U. Borde, of New Orleans, who acted as consulting engineer for this company.

The entire 1,500 horse-power for use about the mill is generated at a central point by General Electric generators and is distributed through cables to motors located at the machines to be driven. The three generators, direct-driven by slow-speed engines and delivering current to the line at 2,300 volts are excited by current from two direct-current marine-engine sets shown in the foreground of Fig. 2. The entire current is carried to the mill through cables in underground steel conduits. The heavy black line running to the left from the power-house in Fig. 1 shows the course of the underground conduit supplying the two planing mills, sorter and stacker and ending with the forty-two motors in the main planing mill.

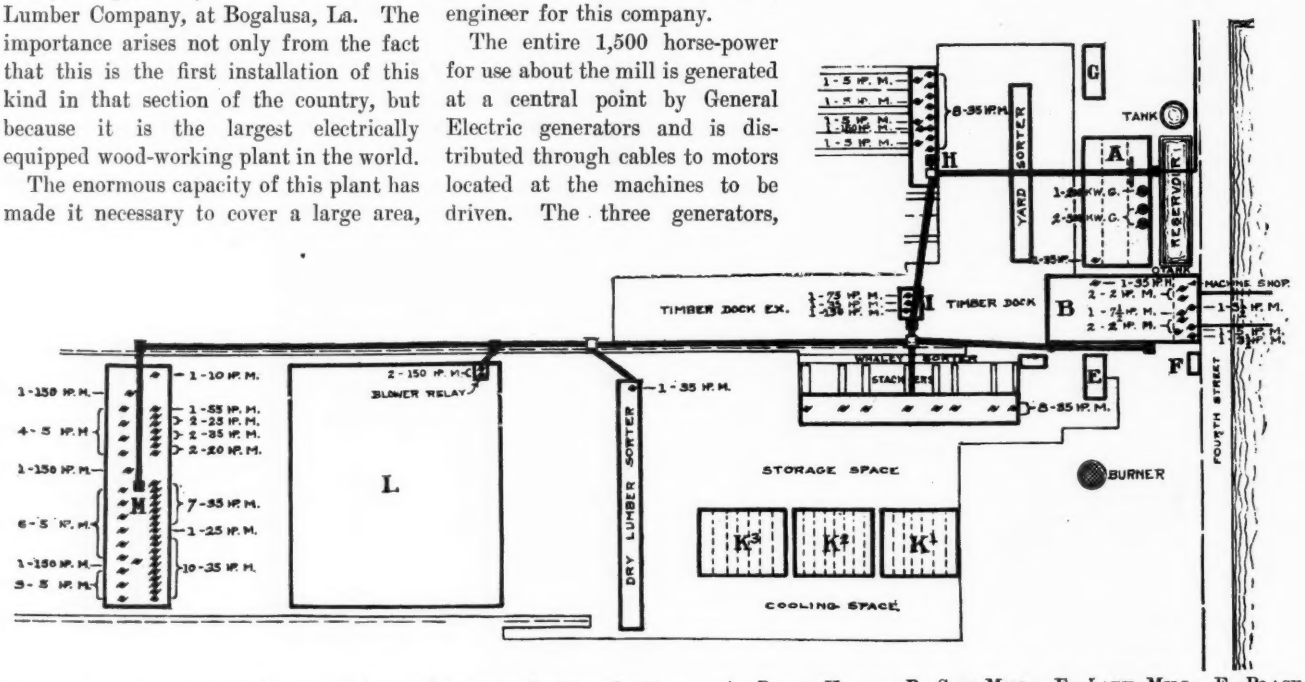


FIG. 1.—PLAN OF BOGALUSA PLANT OF GREAT SOUTHERN LUMBER COMPANY. A—POWER-HOUSE; B—SAW MILL; E—LATH MILL; F—BLACKSMITH SHOP; G—TURPENTINE PLANT; H—PLANING MILL; K—KILN BATTERIES; L—ROUGH LUMBER SHED; M—MAIN PLANING MILL.

The wood-working machinery, furnished by the Berlin Machine Company, as well as the auxiliary apparatus and sizes of motors, is listed in the following table:

PLANING MILL NO. 1.

13 16-inch No. 238 trim saws, each direct-coupled to five-horse-power, 1,200-revolutions-per-minute motor.
17 No. 94 planers and matchers, each direct-coupled to thirty-five-horse-power, 900-revolutions-per-minute motor.
2 No. 266 three-saw gang edgers, each belted to thirty-five-horse-power, 900-revolutions-per-minute motor.
1 64-inch No. 285 band rip saw, direct-coupled to fifty-five-horse-power, 514-revolutions-per-minute motor.
1 44-inch No. 283 band rip saw, direct-coupled to twenty-five-horse-power, 600-revolutions-per-minute motor.
1 44-inch No. 281 band rip saw, direct-coupled to twenty-five-horse-power 600-revolutions-per-minute motor.
1 30-inch No. 177 double surfacer, direct-coupled to thirty-five-horse-power, 900-revolutions-per-minute motor.
3 double 70-inch Sturtevant blowers, each direct-belted to 150-horse-power, 600-revolutions-per-minute motor.
All machinery in the filing room is connected with line shafting, belted to a ten-horse-power, 1,200-revolutions-per-minute motor.

PLANING MILL NO. 2.

8 No. 94 planers and matchers, each direct-coupled to thirty-five-horse-power, 900-revolutions-per-minute motor.
1 44-inch No. 281 band rip saw, direct-coupled to twenty-five-horse-power, 600-revolutions-per-minute motor.
4 16-inch No. 238 trim saws, each coupled to five-horse-power, 1,200-revolutions-per-minute motor.
1 double 70-inch Sturtevant blower, direct-coupled to 150-horse-power, 600-revolutions-per-minute motor.

PLANING MILL ON TIMBER DOCK.

1 30-inch by 20-inch No. 1 timber sizer, direct-coupled to eighty-five-horse-power, 900 revolutions-per-minute motor.

1 No. 94 planer and matcher, direct-coupled to thirty-five-horse-power, 900-revolutions-per-minute motor.
1 double 60-inch Sturtevant blower, direct-coupled to 150-horse-power, 600-revolutions-per-minute motor.
1 seven-and-one-half-horse-power motor connected to planer.
1 two-horse-power motor connected to pipe machine.
1 two-horse-power motor connected to pipe machine.

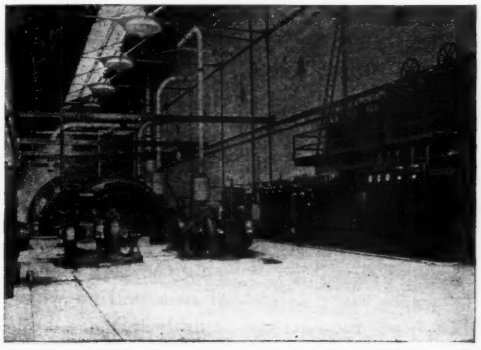


FIG. 2.—POWER-HOUSE OF GREAT SOUTHERN LUMBER COMPANY.

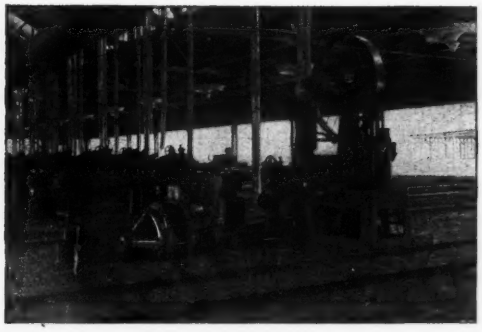


FIG. 3.—BERLIN BAND RESAW, DIRECT-CONNECTED TO GENERAL ELECTRIC FIFTY-FIVE-HORSE-POWER INDUCTION MOTOR.

FIG. 4.—STURTEVANT BLOWER, BELT-CONNECTED TO GENERAL ELECTRIC 150-HORSE-POWER INDUCTION MOTOR.

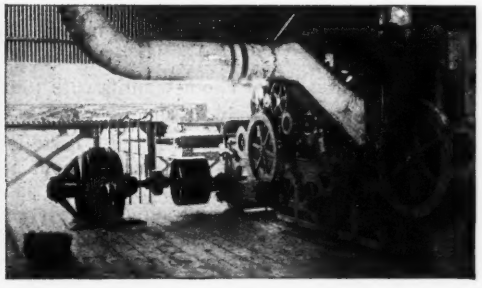


FIG. 5.—TIMBER SIZER, DIRECT-CONNECTED TO GENERAL ELECTRIC EIGHTY-FIVE-HORSE-POWER INDUCTION MOTOR.

FIG. 6.—BERLIN BAND RESAW SHOWING INDUCTION MOTOR AND MOTOR STARTER.

DRY LUMBER SORTER.

Dry lumber sorter, driven by one thirty-five-horse-power, 900-revolutions-per-minute belted motor.

LUMBER STACKERS.

8 lumber stackers, driven by eight twenty-five-horse-power, 600-revolutions-per-minute belted motors.

FUEL CONVEYERS.

2 fuel conveyers, driven by two thirty-five-horse-power, 900-revolutions-per-minute belted motors.

CENTRIFUGAL PUMPS.

2 14-inch centrifugal pumps for pumping into log ponds, each direct-coupled to eighty-five-horse-power, 720-revolutions-per-minute motor.

MACHINE SHOP.

1 two-horse-power motor connected to upright drill.
1 two-horse-power motor connected to bolt cutter.
1 three-and-one-half-horse-power motor connected to shaper.
1 five-horse-power motor connected to radial drill.
1 three-and-one-half-horse-power motor connected to machine lathe.

RELAY BLOWER STATIONS.

1 double 70-inch Sturtevant blower, belted to 150-horse-power, 600-revolutions-per-minute motor.

Transformers inside the mills reduce the pressure to 440 volts, at which pressure the motors driving the various mill machines are operated. All of the machines in the three mills of this plant are driven by the General Electric Company's form M induction motors which, on account of their extreme simplicity and sturdiness, are especially suited to this class of work. Moreover the electric motor of such sizes as are used in this work is essentially a high-speed, high-efficiency machine, making it not only possible but highly desirable to connect this direct to the shaft of the tool to be driven. This has been done in all except a few instances, as the higher efficiency obtained with the absence of long belts and lines of overhead shafting more than justifies the extra first cost for individual motors. Saws, shapers, joiners, are all connected direct to the driving motor. The good lighting and entire absence of belts are well shown in Fig. 3, which illustrates the direct motor drive to one of the Berlin band rip saws.

The dust, which is generally such an obstacle to the satisfactory operation of planing mills, is removed by electricity. Seven double blowers are driven by 150-horse-power motors drawing the dust up through a system of pipes. These blowers are distributed through the mill as follows:

One in each of the small planing mills H and I shown in the diagram, two in the rough lumber shed and three in the main planing mill. About eight ounces pressure is maintained by these, which not only carries away dust and fine shavings but also knots and large chips. One of these large blowers is shown in Fig. 4 and the arrangement of the pipes is well shown in Fig. 3.

Fig. 5, showing an eighty-five-horse-power motor connected to a timber sizer, gives a very good idea of the simplicity and compactness of this form of drive. This sizer is in the planing mill on the timber dock as shown in the diagram.

Each of the motors is supplied with a starting device and protecting fuses at the motor so that each machine is a plant in itself and practically independent of the other machines. Fig. 6 shows one of these starting compensators connected to a motor driving a band edger. The fuses at each machine protect that motor and its cable from internal injury, and as the cables are encased in iron conduits fire danger is eliminated.

The entire installation is one that exemplifies the best, the most economical methods of handling lumber, and the cleanliness and flexibility secured by the improved methods used are making the dusty sawmills of the past more and more uncommon.

The Electric Club of Chicago.

The Electric Club, of Chicago, Ill., is to be addressed at its August meeting by William D. Day, contract agent of the Sanitary District of Chicago, on the subject of disposing of the current generated at the hydroelectric development at Lockport.

Westinghouse Nernst Lamps.

Some interesting developments have been taking place in the laboratory of the Nernst Lamp Company, lately, and as a result, it is now only a question of the time required to perfect manufacturing detail, until the company will show some entirely new units.

The Nernst Lamp Company, it will be remembered, was the pioneer in bringing out a high-efficiency incandescent unit, when the original lamp was put on the market, and for some time thereafter it stood alone in the high-efficiency field. Then came in fast succession, the metallized filament, the tantalum and the tungsten. Undoubtedly, besides bringing about a reduction in lighting bills that opened up new fields for many central stations, the Nernst had its effect in stimulating the developments referred to above.

Its own further development in point of efficiency is a matter that has been looked forward to with considerable interest, for the Nernst system has many advocates.

One of the new units which is now ready for the market, it is stated, shows a mean hemispherical efficiency of 1.12 as against 1.65 shown by the corresponding old unit. This represents an improvement of thirty-two per cent and will make competition very close. When the circumstances are taken into consideration, this improvement not only does not seem extraordinary, but it indicates that a still higher efficiency may yet be reached. Just as the efficiency of a filament lamp depends upon the material of which the filament is made, so does the efficiency of the Nernst depend upon the glower material. This material is still in the development stage and there are so many different elements that may be used, offering so many different combinations that the present combination representing a thirty-two per cent increase, may be looked upon as only a step in its final development.

There are other features besides efficiency, however, that must be taken into consideration in selecting a lighting system. Maintenance is scarcely of less importance. In fact, maintenance must be added to efficiency to get the total operating cost per kilowatt-hour before a just comparison of systems can be made. The new single-glower units, of which there are four, *i. e.*, sixty-six, eighty-eight, 110 and 132-watts, respectively, are to be provided with screw base renewals; that is, the renewal part of the lamp will be screwed into place just as in ordinary incandescent-lamp practice. This represents a marked improvement in Nernst-lamp practice and will not only reduce the cost of maintenance but will permit it to be done by any one.

Maintenance has always been one of the debatable questions in connection with the Nernst system. Because it is an intermediate system between the ordinary incandescent and the arc, human nature naturally expects it to have all the advantages of the former and none of the disadvantages of the latter. As a matter of fact, its maintenance has shown up satisfactorily in large installations justifying an attendant and in small installations having a maintenance contract with the lamp company or a local lighting company. It is chiefly from isolated installations where some one unfamiliar with electricity undertakes to look after the lamps, that criticism has come. Such as these will find in the new renewals something that they can handle without doubt of obtaining satisfactory results.

A point to the advantage of the Nernst system is its wide range of units giving uniform illumination throughout an installation, including windows and the exterior, no matter how diverse the requirements. The new units with four different sizes in the single-glower, will further increase this range. Taste in illumination varies all the way from an entirely concealed system to myriads of small units peeping out from every point that will hold a lamp. The Nernst system is applicable to practically every effect except the latter extreme, which more properly comes under the head of decoration than of illumination.

Downward distribution remains a prominent characteristic of the system, rendering the use of reflectors entirely unnecessary.

When the Nernst system was first introduced it was badly handicapped by being suitable for alternating-current circuits only. A couple of years ago direct-current lamps were brought out and proved successful. The new units will operate equally well on either alternating or direct current, 110 or 220 volts.

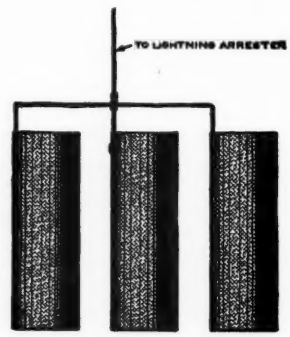
For Squealing Commutators.

The Joseph Dixon Crucible Company, Jersey City, N. J., reports that its graphite brushes, which are made in only one quality, are giving most excellent satisfaction. They frankly acknowledge in their literature that a one-quality brush is not adapted to all conditions, but do say where their brushes are adapted they give unexcelled service. Their use results in the commutator's taking on in a short time a highly polished surface, smooth and well rounded. They state that since the installation of their own electric plant some eight years ago, they have not had occasion to turn down their commutators, and reasonably attribute the condition of the commutator to the use of their graphite brushes.

The Federal Cartridge Ground Plate.

The Federal cartridge ground plate commends itself to all practical men who have wrestled with the problem of making satisfactory ground connections in either telephone, street railway or electric lighting work. By its use a practically perfect ground can be secured at a minimum of expense and trouble.

This device is gotten up in standard sizes with a specific area of plate and size of ground wire. The copper surface is completely covered with the proper grade of charcoal for securing the best ground. The whole is incased in a netting which holds the charcoal securely in place while handling, but breaks down when installed, allowing the earth to mix with the finely



TYPICAL MULTIPLE INSTALLATION CARTRIDGE GROUND PLATES. PATENTED.

divided charcoal. The netting is meant to disintegrate rapidly as soon as the cartridge has been buried in moist earth. The heavy copper ground wire is firmly secured to the copper plate through its entire length so that there is no chance for a break or loose connection.

Each complete plate is put up in a cylindrical cardboard case which is for transportation only and is, of course, removed when the plate is put in the ground. The hole can be made easily with a standard post-hole digger so that the labor of installing is light.

The manufacturers suggest that a piece of fibre conduit be used to protect the wire from the ground plate to a point well above the surface of the ground. A rope drain fitted on the post or wall will lead considerable rainwater into this fibre conduit and so direct to the ground plate, insuring moist earth around the plate.

This ground plate is manufactured by the Federal Electric Company, Lake and Desplaines streets, Chicago, Ill.

A NEW FORM OF DIRECT-CURRENT AMMETER AND VOLTMETER.

BY P. MAC GAHAN.

There exists a considerable demand for a line of small-size direct-current switchboard ammeters and voltmeters of the highest grade and accuracy, so constructed as to be low in price.

Recent improvements in factory methods and in design features by the Westinghouse Electric and Manufacturing Company have rendered possible the production of a small-sized switchboard instrument of the permanent-magnet type, at a price as low as that of the best moving iron instruments previously available. The result has been the instruments herein described, which possess unique features and advantages not previously obtained with any type of construction. These instruments are made as ammeters and voltmeters and are mounted in neat black Electrose cases, five inches in diameter, rear-connected, with circular beveled-glass front-plates.

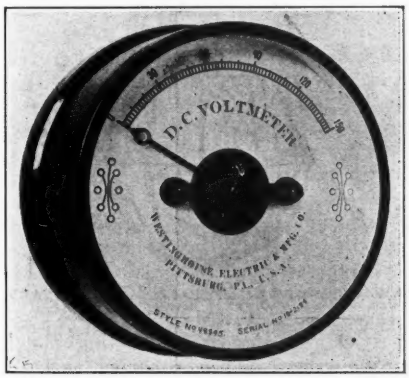


FIG. 1.—WESTINGHOUSE DIRECT-CURRENT VOLTMETER.

The use of a case made from insulating material instead of metal gives a degree of insulation not usually found in small instruments. Owing to the peculiar self-shielding form of the permanent magnets, an iron case is not necessary for shielding against the effects of external fields.

The meters are supported by means of brass studs projecting from the rear of the case, serving at the same time as terminals.

The voltmeters are made self-contained, including resistance, in any capacity as high as 300 volts, and the ammeters are operated from external shunts, the shunts of the capacities up to and including seventy-five amperes being mounted directly on the meter studs.

The scale divisions are uniform and the total length is almost the same as that found in the usual seven-inch-diameter meters.

From a technical point of view the most interesting feature of these instruments is the "single-air-gap" type of construction, which differs considerably from the original D'Arsonval bipolar magnet with two cylindrical air-gaps in series.

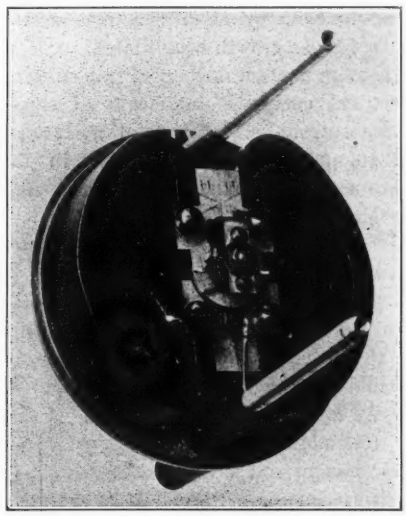


FIG. 2.—INTERNAL VIEW OF METER MECHANISM.

The principal advantages of the single-air-gap construction in permanent magnet meters are as follows:

1. The possibility of removing the moving element from the magnetic structure without interfering with the magnets or removing their pole-pieces.

2. The coil balancing the weight of the pointer.

3. Single air-gap means that larger air-gap clearances may be used without making the total magnetic reluctance of the air-gap too high.

The removability of the permanent magnets is really of the greatest importance to the user who desires to do his own repair work on the premises.

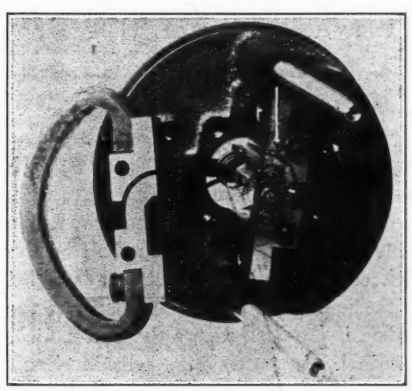


FIG. 3.—METHOD OF REMOVING PERMANENT MAGNET.

Fig. 2 shows an internal view of the meter mechanism with the case removed.

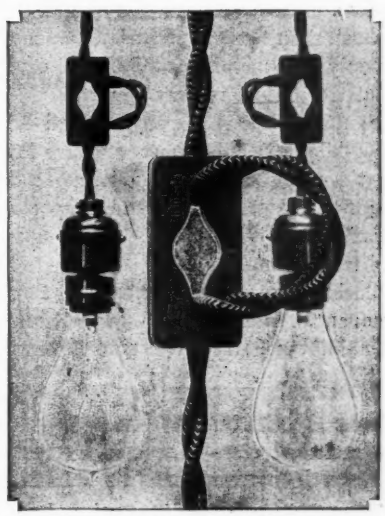
Fig. 3 shows the process of removing the permanent magnets when repairs become necessary.

The principal applications for this class of instrument will be for small panels, such as for rectifier outfits, battery charging, small isolated plants, small marine plants, or even on regular large switchboard work where a small-sized instrument is desirable.

The low price is due to the economic disposition of the material used, the light weight, and the fact that there are no hand operations used in manufacture, aside from the assembly. The parts are all machine-made in large quantities, with a highly organized and accurate tool equipment, the assembler merely attaching these parts together without further fitting.

The Easy Cord Adjuster.

One of those simple little things that anybody ought to have thought of is the "Easy" cord adjuster, the use, simplicity and advantages of which are clearly shown in the accompanying illustration. This little specialty is made of the finest grade of red fibre. It will be seen that it contains a slot through the centre, running lengthwise. This slot is made considerably wider at the centre, which permits a double cord to be easily inserted and pulled through any desired length. The tapering ends of the slot hold the cord firmly and keep it from slipping. The dimensions of the "Easy" cord adjuster are two inches by one inch by one-sixteenth inch and one hundred weigh ten ounces. W. N. Matthews & Brother, of St. Louis, Mo., the manufacturers, state that they have sold thousands to contractors and jobbers all over the United States.



THE "EASY" CORD ADJUSTER.

New Orders.

The General Electric Company announces that the following orders for new apparatus have been recently received:

Isthmian Canal Commission—Six vertical Curtis turbine units, 1,500 kilowatts, twenty-five cycles, 2,200 volts, each complete with individual base condenser, air and circulating pumps and necessary piping; electrical equipment for one twenty-ton traveling crane; four thirty-five-kilowatt, 125-volt, direct-current turbine-driven exciters; four 500-kilowatt, 600-volt, rotary converters, each complete with three air-blast type transformers; six 100-kilowatt, 2,200-6,600-volt, single-phase, oil-cooled transformers; six 110-kilowatt, air-blast type transformers; two switchboard equipments.

Mitsui & Company, Japan — Fifty GE-52 railway-motor equipments, also rotary converters, transformers, etc.; twenty GE-52 double-motor equipments, with headlights and spare parts; three 1,000-kilowatt alternating-current generators.

Australian General Electric Company—Seventy four-motor type M control equipments for GE-81 railway motors.

Santos Dock Company, Brazil—Six 3,000-kilowatt transformers and five fifty-light constant-current transformers; one motor-generator set; 628 arc lamps; one switchboard; miscellaneous small motors and transformers.

Pueblo Tramway Light and Power Company, Mexico — Ten water-cooled, 1,500-kilowatt, sixty-cycle transformers.

More Electrical Machinery for Guadalajara — Large Extension to Juanacatlan Plant.

The Compania de Transvias Luz y Fuerza de Guadalajara, South America, which company is the result of the combination of the two former electrical companies of that city, and operates not only the entire lighting system, but also the railway system of Guadalajara, have en route to Mexico a large order for additional electrical machinery which was bought from Messrs. G. & O. Braniff & Company, of Mexico City.

In order to meet the increasing demand for electrical power in Guadalajara, this company, finding that their power-generating stations at La Junta and Juanacatlan were insufficient, found it necessary to purchase a 750-kilovolt-ampere, modern, Westinghouse, three-phase, belted-type generator, which will be installed at Juanacatlan. This new generator is but one of the four which will be installed as needed.

The latter station was one of the first electric-power plants in the country; the original installation consisting of single-phase machines, which were added to from time to time by other machines of the same type as growth necessitated.

A more modern method of transmitting electrical energy is by means of three-phase current, on account of the saving of amount of copper required in the transmission line, and is now almost universally in use.

The Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., is supplying the new electrical machinery. This extension was necessitated not only by the operating of electrical railways in Guadalajara, which now have been in service for the last several months, but also by the additional power required from their present and new subscribers.

The "Patterson" Wireless Dry-Battery Holder.

Stanley & Patterson, 23 Murray street, New York city, have placed on the market a wireless dry-battery holder which presents many advantages for the user of dry batteries for any purpose. This holder eliminates binding-posts and wire connectors and is made to take from one to six cells. If more than six cells are used any combination of holders may be utilized to fit the requirements.

The "Patterson" Wireless Battery Holder.

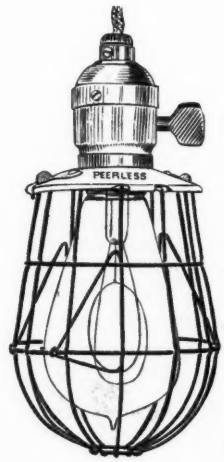
The cells used with this holder are the same as standard two and one-half by six-inch cells, except that a thread is rolled at the upper end of the zinc cup and the carbon is provided with a flat-butt contact terminal. In putting the cells in circuit all that is necessary is to screw the cell into one of the sockets the same as an incandescent lamp.

A feature of one form of the wireless battery holder is the automatic bridge, which comes into action, closing the circuit between the adjacent batteries, if it should be necessary to remove a dead or defective cell from circuit, and there was not another cell available at the moment. When a new cell is procured it is simply screwed into place, and the power of the new cell is added to those already connected up.

A New Lamp Guard.

The accompanying illustration shows one application of the "Peerless" lamp guard, manufactured by the Greenwood Manufacturing and Supply Company, 141 Milk street, Boston, Mass.

This lamp guard has a canopy-shaped, divided metal top, which is hinged to both sides of the cage and has a swivel catch, which fastens it rigidly to the sockets. The guard is made with tops to fit snugly to all styles of sockets, whether metal, porcelain, hard rubber or molded mica. It is made in one piece, and gives maximum rigidity with minimum obstruction to the light. The flat metal tops are nicely finished and nickel plated and the wire parts are coated with pure tin.



The Greenwood "Peerless" Lamp Guard.

Holophane Convention.

The fourth annual convention of sales, engineering and manufacturing departments of the Holophane Company was held at Hotel Sagamore, Lake George, July 12 to 18. The party, consisting of some forty salesmen, department heads and executive officers, in addition to whom were the wives of a half-dozen of the men and several invited guests, making a party of over fifty.

Conferences on matters of business and policy occupied the mornings, the men engaging in sports and pleasure jaunts in the afternoons. A number of very important matters were discussed and plans adopted which will greatly enlarge the scope of the Holophane Company's work in future. Announcements of these changes will be made shortly.

Current Electrical News

DOMESTIC AND EXPORT.

A MILLION-DOLLAR LIGHT AND POWER MERGER—Following a meeting of the directors of the People's Light, Heat and Power Company on July 23, it was announced that a merger of that company with the Home Light, Heat and Power Company, both of Springfield, Ohio, would be effected in the near future. The capital stock of the new company will be $1,000,000. Columbus, New York and Boston men are interested in the new company.

PORTLAND RAILWAY, LIGHT AND POWER COMPANY TO SPEND $1,000,000—The contract has been let by the Portland Railway, Light and Power Company for the building of an underground system of conduits and cables in the business district, as required by city ordinance. The contract amounts to over $1,000,000, and was awarded to the engineering firm of William S. Barstow & Company, of New York. With the installation of the new system, current service to consumers throughout the business district will be changed from a 500-volt direct and a 220-volt alternating-current to a 220-volt direct-current when the system is complete, which will mean the changing of all motors in the underground district now installed to 220 volts direct current.

BOSTON INDEPENDENT TELEPHONE COMPANY TO GET BUSY—The Metropolitan Home Telephone Company, which received a franchise from the city of Boston in December, 1906, is finally taking steps toward beginning construction of its independent telephone system. Under the terms of its franchise, the company must begin construction before January 1 next and have in operation before January 1, 1910, a telephone system adequate for the service of 20,000 subscribers. A system for 100,000 subscribers must ultimately be in operation. In consideration of the franchise, the company will furnish the city with free telephones in the ratio of one telephone for each 2,000 of population of the city, additional telephones to be paid for by the city at a discount of thirty-three and one-third per cent from the company's established rates.

OREGON TELEPHONE CONSOLIDATION—It is rumored that a consolidation of the Home Telephone Company and the Pacific Telephone and Telegraph Company is in prospect, and will take place as soon as certain details can be harmoniously arranged. This proposed combination of interests is reported to have been under serious consideration by the officials of the rival telephone companies since the first of the year, during the time negotiations were being carried on for consolidation of the systems of the Pacific Telephone and Telegraph Company and the Independent Telephone Company, at Seattle. Though greater obstacles will have to be overcome in Portland in operating the systems of the rival corporations than in Seattle, owing to franchise provisions and dissimilarity of apparatus, yet it is said that a practical plan has been formed.

ELECTRIC LIGHTING.

HEPPNER, ORE.—The electric plant at Heppner was destroyed by a cloudburst on July 13.

MUNNSVILLE, N. Y.—The city of Munnsville is to build an electric light plant and displace the present street oil lamps.

SALEM, OHIO—The Salem Electric Light and Power Company is completing plans for the construction of a new power-house.

LIMA, OHIO—At a meeting of the city council held on July 6 it was decided to employ an electrical engineer to prepare plans and estimates for the building of a city electric light plant.

ATKINS, ARK.—The town council of Atkins has granted a thirty-year electric light franchise to W. F. Turner, of Atkins, who will at once proceed to have an electric light and power plant installed and put in operation.

KEENE, N. H.—Stockholders of the Keene Gas and Electric Company and the Citizens' Electric Company have voted to consolidate the two properties. The former company is to issue $50,000 four per cent bonds to be exchanged share for share for the Citizens' company.

WEAVERVILLE, N. C.—The certificates of incorporation of the Weaverville Electric Company have been received. The charter is granted to R. S. Howland, John H. Carter and G. W. Eppes, all of Asheville. The powers granted in the charter are broad and inclusive.

BUTTE, MONT.—At the annual meeting of the stockholders of the Butte Electric and Power Company held in Jersey City, N. J., on July 15, the retiring board of directors was re-elected, with the exception that G. F. Panfield was elected in the place of Rudolph Kleybolte.

HATTIESBURG, MISS.—G. L. Hawkins, of the banking firm of F. W. Foote, is one of the leading interests in a company which has laid about nine miles of street railway in this city. The company has practically negotiated the sale of their bonds and will soon have the necessary money to buy cars and other equipment. New work will probably be started in thirty days.

PINE BLUFF, ARK.—Ralph L. Crump, of New York, representing the Equitable Security Company, has bought the property of the Pine Bluff Light and Water Company, including the gas, electric light and water plants, for $450,000. The sale was under authority of the United States Circuit Court, and was a matter of formality, Crump representing the company's bondholders.

WOONSOCKET, R. I.—The common council, on recommendation of the joint standing committee on street lights, comprising Councilmen Rhodes, Dulude and Cornell and Alderman Mullen, has adopted a resolution contracting with the Woonsocket Electric Machine and Power Company for arc lights for five years at $120 a year and for forty-candle-power incandescents at $30 a year.

CLINTON, MASS.—The first vote in connection with the purchase by the town of the Clinton Electric Light and Power Company was taken at a special town meeting on July 14, when the report of a special committee recommending an appropriation for further investigation into the matter was adopted. The vote was in favor of municipal ownership, being 223 to 27.

RALEIGH, N. C.—The state has authorized the Central Carolina Power Company, which built and operates the plant at Buckhorn Falls, on the Cape Fear River, to change its name to the Carolina Light and Power Company; to change its office from Fayetteville to Raleigh, and to increase its capital stock from $1,000,000 to $3,750,000. The Electric Bond and Share Company is the principal stockholder. James D. Mortimer, of New York city, is president.

TITUSVILLE, N. Y.—The plant of the Titusville Electric Light and Power Company, together with its bonded indebtedness and all of its other perquisites, has passed into the hands of John L. and J. C. McKinney, who have organized a company consisting of themselves, R. E. Dickinson and Fred Woodring. Mr. Dickinson will be secretary and treasurer and Mr. Woodring will act as superintendent, a position which he has held in the plant for the past three years. The purchase price was approximately $75,000.

NIAGARA FALLS, N. Y.—The Niagara Falls Power Company has let contracts for an addition to the transformer house of its Canadian Niagara Power Company across the river. It is expected that the plant will be ready for operation by October 1. A new set of dynamos will be installed, and the output of the plant, which is 20,000 horse-power, will be increased to 32,500 horse-power. The Niagara Falls Power Company is now stringing a new transmission line between Niagara Falls and Buffalo, to enter Buffalo just east of Ferry street.

TELEPHONE AND TELEGRAPH.

WEST CHESTER, PA.—The Millway & Rothsville Telephone Company has been organized, with Dr. H. Walter, of Rothsville, as president.

AZUSA, CAL.—The Covina Home Telephone Company has opened its branch exchange. It will serve about 400 patrons in Glendora and Azusa.

TACOMA, WASH.—Arrangements are being made for the construction of a telephone line from Ashford, in the Succotash Valley, to Longmire Springs, on the west slope of Mount Rainier.

PHOENIX, ARIZ.—The board of supervisors have granted the People's Independent Telephone Company a franchise, extending to every part of Maricopa County, for a period of fifty years. The company first asked for a perpetual franchise, but the board would not grant it.

LITTLE ROCK, ARK.—The North Louisiana Telephone Company is constructing a line from Ruston, La., to El Dorado and has a contract with the Rock Island to extend the line to Little Rock. It is said to be the intention to put in a copper circuit and operate a long-distance line from Ruston to Little Rock and intermediate points.

SNOHOMISH, WASH.—Acting under instructions from the Chamber of Commerce, a committee is circulating an agreement of incorporation for the purpose of organizing a home telephone company. For several weeks the independent company has been boycotted for cutting off free long-distance territory and giving it to Everett.

PEKIN, ILL.—The directors of the Farmers' Mutual Telephone Company will hold a meeting in Pekin on August 1 to discuss plans for the building of a new line, or perhaps purchasing the old independent line. At a meeting in Pekin recently the secretary-treasurer, Arthur Becker, was authorized to secure quarters in Tremont for the head office, also to collect up the subscriptions for stock.

BELLEVERNON, PA.—Application has been made for a state charter for the Westmoreland & Fayette Telephone Company. It is to be capitalized at $1,000, divided into forty shares. The stock is said to be oversubscribed. The intention is to build farmers' lines in this vicinity, also connecting the towns of Bellevernon, Fayette City, Perryopolis, West Newton, Smithton, Monessen and Webster.

ONEIDA, N. Y.—A new independent telephone company has asked for a franchise to construct lines and cables in this city. It is understood that a number of local capitalists are interested in the venture. It is understood that the new company, if it secures its franchise, will at once commence work and will open an office here for business, connecting with Syracuse and Utica and other places near here.

VANCOUVER, WASH.—The franchise of the Washington Home Telephone Company in this city has been sold to H. J. Roake, who, with several local business men, will at once begin the work of constructing the exchange. The new company will be formed with local officers. The construction money will be raised by Vancouver men, and no bonds will be sold. It is expected to have telephones in operation by January 1, 1909.

WHEELING, W. VA.—At a meeting of the directors of the Belmont Telephone Company final action was taken in regard to issuing $100,000 of new preferred stock to make extensive extensions of the system and to redeem the greater part of the outstanding bonds. The extensions of the company's system proposed will take in a good part of eastern Ohio, and all of Belmont County that is not already included in the circuits.

MULLEN, NEB.—The Hooker County Telephone Company has elected the following officers: Dr. D. A. Walker, Mullen, president; F. A. Meidell, Seneca, vice-president; Charles Rodgers, Mullen, treasurer; A. L. Dawson, Seneca, secretary; Ross Fleming, Theron E. Evans and M. R. Fessenden, of Seneca, directors. A new $140 switchboard has been placed in Mullen and gives this line free exchange with the lines running to Brownlee.

SALTILLO, MEXICO—General Geronimo Treviño has been granted a telephone concession by the government of Coahuila. The concession exempts from either state or municipal taxation the capital that will be invested in the installation of a telephone line from the hacienda La Bahia to the town of Muzquiz, Coahuila. He has also been granted permission to use the streets and roads to place the poles and in return agrees to transmit free of charge all official communications.

CHESTNUT MOUND, TENN.—A new enterprise, to be known as the Chestnut Mound Home Telephone Company, has been launched. A meeting of the stockholders has been held, perfecting an organization, electing the following temporary officers: L. C. Thompson, president; A. H. King, vice-president; J. P. Elrod, secretary; F. C. Hargis, treasurer. This is a home institution and connections will be made with all the nearby towns and on to Nashville by way of Gordonsville will be the outcome.

NEWCASTLE, PA.—Plans to merge a number of small independent telephone companies in this locality may result in the formation of a central company, to be known as the Inter-State Telephone Company. If the project is consummated the central company will have $100,000 capital and will control about 3,500 telephones. The companies located in Plaingrove, New Wilmington, Mt. Air, Blacktown, Slippery Rock, Harrisville and New Bedford in this state and Beaver and North Jackson in Ohio, are to be included in the merger.

LANCASTER, PA.—The Landisville Telephone Company has been granted a charter. Residents of Landisville and the surrounding country, objecting to the prevailing toll charges, decided to construct their own line, a large portion of which has already been erected. In addition to Landisville, it will reach Rohrerstown, Bamford, Silver Spring, Garber's Mill, Salunga, East Petersburg and Mechanicsville. The directors of the company are: J. M. Trout, H. H. Koser, P. W. Baker, Ezra Miller, J. L. Minnich, D. R. Stauffer, C. C. Greider, J. W. Kreider, H. W. Minnich, S. N. Root, H. B. Stauffer, F. H. Shenk and A. H. Hoffman.

HARRISBURG, ARK.—The Going Telephone Company was organized recently at Harrisburg. The officers elected were: L. C. Going, president; W. N. Harris, vice-president and general manager; May E. Hart, secretary and treasurer; J. C. Mitchell, auditor. The company is capitalized at $50,000, of which $35,000 has been subscribed. It is expected that within the next six months about $25,000 will be expended in the building and acquisition of telephone exchanges and long-distance lines in and to the towns in eastern Arkansas. The new corporation takes over the Harrisburg Telephone Company's system and franchises. The headquarters of the company will be maintained at Harrisburg.

NAPA, CAL.—The Clear Lake Telephone and Telegraph Company, a new competing line, has been organized and articles of incorporation filed in the office of the county clerk. The company intends to construct and operate new telephone lines in Napa, Sonoma, Mendocino and Lake counties, principally between the following points: From Lakeport to Calistoga, from Lakeport to Cloverdale *via* Highland Springs and Pieta, from Lakeport to Kelseyville and from Pieta to Hopland. The company has a capital stock of $50,000, and the board of directors consists of A. H. Spurr, of Lakeport; H. S. Johnson and F. L. Wright, of Santa Rosa. L. J. Shuman and M. S. Sayre, of Lake County, are also largely interested in the new company.

ANACONDA, MONT.—The directors of the Montana Independent Telephone company have elected the following officers: Harry A. Gallwey, Butte, president; Dr. W. H. Hall, Butte, vice-president; Charles J. Kelly, Butte, secretary and treasurer; Thaddeus S. Lane, Butte, managing director. Patrick Wall, general manager of the East Butte Mining Company, was added to the board of directors, the board now being composed as follows: H. A. Gallwey, M. S. Largey, Patrick Wall, W. H. Hall, H. D. Brown, Thaddeus S. Lane, L. O. Evans, Con F. Kelley, J. T. O'Brien and Charles F. Kelly, of Butte; W. G. Conrad and Thamos Couch, Jr., of Great Falls; Frank H. Clinton, of Anaconda. The Anaconda exchange will be open for business some time in the latter part of July. The eastern extension has been completed to the Nine Mile House, nine miles southeast of Butte. Material has been ordered for the further extension to Logan, Mont., where connections will be made with the Bozeman independent company's lines, and all other independent lines in eastern Montana. This extension will be completed during the summer.

PERSONAL MENTION.

MR. T. G. SEIXAS, of New York, has been appointed general manager of the Pacific Traction Company, of Tacoma, Wash.

MR. R. B. BENJAMIN, president of the Benjamin Electric Manufacturing Company, Chicago, Ill., has gone to London, England, for the purpose of establishing a branch office and factory for manufacturing and handling the company's wireless clusters and lighting specialties abroad. He is accompanied by Mr. B. J. Grigsby, of the engineering department, who will be left in charge upon Mr. Benjamin's return. A stay of from four to five weeks is contemplated.

MR. WILLIAM W. COLE, for many years the able manager of the Elmira Water, Light and Railway Company, has resigned to become associated with the firm of Dodge & Day. Mr. Cole was presented with a handsome diamond ring by Roy H. Smith, secretary of the Chamber of Commerce, on behalf of the railroad employés of the company. The gas and electrical departments also presented Mr. Cole with a diamond scarf pin as a token of their esteem and affection. Mr. Cole is succeeded by Samuel J. Dill.

MR. JAMES F. HEYWARD, who has been appointed general manager of the Maryland Electric Railways Company, with headquarters in Baltimore, was presented with a handsome silk umbrella by the employés of the Citizens' Traction Company, of Pittsburg, when he resigned on July 23 as general manager. The Franklin & Oil City Street Car Men's Union made the presentation and declared that they were sorry to see him leave. Mr. Heyward is not unknown in Baltimore, having been long connected with the local street railway service before the general consolidation. He was the right-hand man of the late Nelson Perin and was the general manager of the City & Suburban line before the merger.

MR. V. R. LANSINGH sailed for Europe on Saturday, July 25, to be gone for six weeks. He will spend the greater part of this time in studying recent European developments in the science of illumination and in going over the situation there as regards Holophane specialties. It is not generally known that Holophane globes were first brought out in Belgium, England and France and that the American company was in the beginning looked upon as a precarious enterprise. The Yankee glassmaker, however, is far in advance of the foreign artisan. Globes produced in America are considered superior to those of European manufacture and are also cheaper, so that the company of which Mr. Lansingh is the head is to-day successful both technically and commercially. It is expected that certain of the styles developed abroad will be acceptable to this market and it is to arrange for an interchange of ideas and experience that Mr. Lansingh is making this trip.

MAJOR E. L. ZALINSKI, U. S. A., retired, has assumed the presidency of the Bureau of Illuminating Engineering, New York city. Major Zalinski, who is naturally of a scientific mind, devoted a great number of years in military research, particularly that of artillery, and is the inventor of a number of devices of war. Major Zalinski is, perhaps, best known in the elctrical field for his work on the diffusing reflector which he, a short time ago, perfected and brought to the fore, and also through the medium of various articles which he has contributed to the advancement of science and art of illuminating engineering. In these he paid particular attention to the diffusion of artificial light. The Zalinski type of diffusing reflectors are now generally accepted and used throughout this and other countries. After perfecting these reflectors Major Zalinski turned over to a well-known company their commercial development. He is now devoting his entire time to the Bureau of Illuminating Engineering, which is prepared to undertake any problems pertaining to the use of artificial light, and has at its command practical, as well as scientific facilities for solving the most intricate propositions. Inasmuch as the bureau affords independent advice to architects and general users of artificial light, it has readily been accepted and is meeting with immediate success.

ELECTRICAL SECURITIES.

There was a broadening of speculation last week, with increased activity, and a number of smart advances, with a number of securities reaching new high levels for the year. For several days there appeared to be a genuine feeling of confidence and buoyancy. The reversal of the judgment of the trial court in the Standard Oil case indicated to many the outer defense which investments may be sure of in the courts of last resort, and notwithstanding the Executive order for action looking to an immediate retrial, there was decided stimulus felt over the present outcome of the case. The favorable turn taken in the affairs of the Westinghouse Electric and Manufacturing Company gave these shares a good impetus upward which was shared by other electrical securities. Reports of a slow betterment in industry in general are widely current. Dividends have been declared on the following electrical securities: Connecticut Railway and Light Company; regular quarterly dividends of 1 per cent on the common and preferred stocks, payable August 15. Books close July 31 and reopen August 17. Montreal Light, Heat and Power Company; regular quarterly dividend of 1½ per cent, payable August 15 to stock of record July 31.

ELECTRICAL SECURITIES FOR THE WEEK ENDED JULY 25.

New York:	*Closing.*
Allis-Chalmers common	11½
Allis-Chalmers preferred	33¾
Brooklyn Rapid Transit	52¼
Consolidated Gas	140½
General Electric	145¾
Interborough-Metropolitan common	8
Interborough-Metropolitan preferred	22½
Kings County Electric	110
Mackay Companies (Postal Telegraph and Cables) common	67½
Mackay Companies (Postal Telegraph and Cables) preferred	68½
Manhattan Elevated	138⅜
Metropolitan Street Railway	30
New York & New Jersey Telephone	110
Western Union	56
Westinghouse Manufacturing Company	78½

In the fiscal year ended February 29, 1908, the Mackay Companies, in their telegraph department, had five months of normal and seven months of poor business. It seems probable that this experience will be directly reversed during the current year. In the past five months telegraph earnings have been more slowly improving, particularly since the first of June. For the remaining seven months it is practically certain that the telegraph business will be much larger than it was a year ago. The cable business of the Commercial Cable Company has been very satisfactory, and it is understood that June business was actually in excess of June a year ago. This result was in a measure made possible, of course, by the fact that the New York-Havana direct cable is now in service, and is proving a large money earner.

The report of the Kings County Electric Light and Power Company, including the Edison Electric Illuminating Company, for the six months ended June 30, shows gross earnings of $1,776,722, compared with $1,672,835 in 1907; operating and general expenses, $824,660; net, $952,062, an increase of $125,304 over the same period a year ago. Replacements and depreciation, $194,998; fixed charges, $303,280, leaving a balance after dividends of $400,000, of $53,784, an increase of $44,818.

Boston:	*Closing.*
American Telephone and Telegraph	122
Edison Electric Illuminating	216
Massachusetts Electric	47
New England Telephone	113
Western Telephone and Telegraph preferred	70

On June 27 last the New England Telephone Company had a total of 233,731 stations of its own, an increase of 5,870 since the first of the year. Including the Southern Massachusetts Company and sublicensees, the company had on June 27 a total of 296,226 stations connected with its lines. Directors of the New England Telephone Company have declared the regular quarterly dividend of 1½ per cent, payable August 15 to stock of record July 31. Books close August 1 and reopen August 14.

Philadelphia:	*Closing.*
Electric Company of America	10
Electric Storage Battery common	30
Electric Storage Battery preferred	35
Philadelphia Electric	9⅝
Philadelphia Rapid Transit	15¼
United Gas Improvement	87½
Chicago:	*Closing.*
Chicago Telephone	138½
Commonwealth Edison	103
Metropolitan Elevated preferred	47
National Carbon common	68
National Carbon preferred	111

ELECTRIC RAILWAYS.

NEW CASTLE, PA.—A new street railway from Beaver to New Castle is planned by the New Castle & Beaver Falls Electric Street Railways Company. Charles Strohecker, of Zelienople, is president.

PALESTINE, TEX.—The Union Central Railway Company has announced its acceptance of the proposition of the citizens of Palestine offering inducements for the road to build into this city. The citizens have pledged the company $25,000 bonus, ten acres for depot facilities and a right of way through the city and county.

ROCHESTER, N. Y.—The Rochester, Charlotte & Manitou Railroad, a trolley line, was sold at auction on July 21 for $12,000 to Kendall B. Castle, a local lawyer, on a foreclosure action brought by bondholders. It is generally supposed that behind the attorney is the Mohawk Valley Company, a branch of the New York Central system.

PHILADELPHIA, PA.—To the accompanying cheers of nearly 500 workmen, the first train of two cars was operated on July 16 in the eastern section of the Market street subway between Fifteenth street station and the station at Second street. Aboard the train, the cars of which were of the steel type used on the elevated section, were President John B. Parsons, P. A. B. Widener, a director; W. S. Twining, chief engineer, and several other officers of the engineering and operating departments of the traction company.

WATERVILLE, WASH.—James Fullerton, of Seattle, has appeared before the county commissioners in behalf of a franchise for an electric line which he proposes to run from a point on the Columbia up the Grand Coulee, with a branch to Waterville. The franchise has not been granted on account of some defects in publishing the notices. Mr. Fullerton said he had secured the right of way the entire length of the line with the exception of three farmers who were holding out and that he did not want to deal with them until after the franchise had been granted.

TACOMA, WASH.—Lucian F. Cook, Henry L. Gray, Charles E. Cutter, C. A. Tonneson and Fred S. Cook have filed articles of incorporation of the Narrows Terminal Belt Railway Company. The company has a capital stock of $250,000. It will construct a trolley line from the end of Center street to Belmarlow Beach. The company also intends the construction of a power plant near American Lake, and a water right allowing it to take 2,000 feet of water per second from the lake has been filed. It is intended to conduct the water from the lake to the Sound, which is 250 feet lower than the lake, in flumes.

GRAND FORKS, N. D.—An ordinance granting to five Grand Forks men a franchise to construct a street railway system in Grand Forks has been given its final reading and passed unanimously by the city council. This means that a stock company will be formed and a street railway built in Grand Forks at an early date. The city already has a line running to the University of North Dakota. This line will be taken over and made part of the new system. The plan is to have a system that will include East Grand Forks. If possible the rails will be laid before the business section of the city is repaved.

LEE'S SUMMIT, MO.—H. W. Gibson, representing the Kansas City Southeastern Traction Company, has been granted a franchise to construct and operate an electric railway on the streets through the city of Lee's Summit. In the granting of the franchise the traction company agrees to begin actual construction of the road inside of one year and to have the road in operation inside of three years, or forfeit the franchise with the city. This line is the proposed line running from Kansas City *via* Leeds, Raytown, Lee's Summit, Lone Jack, thence to Warrensburg, Sedalia and Jefferson City, where they connect with a similar proposed line from St. Louis, which will, when completed, connect Kansas City and St. Louis.

OBITUARY NOTE.

MR. H. G. SHALER, secretary of the Doubleday-Hill Electric Company, Pittsburg, Pa., died in Pittsburg on July 18. Mr. Shaler was a native of Pittsburg and was well known in electrical circles. He was a man of a fine, gentle and generous nature and will be mourned by a host of friends and acquaintances. He is survived by his wife and two children.

NEW MANUFACTURING COMPANIES.

ST. LOUIS, MO.—Grant Electric Company. $3,000. Incorporators: Adolph L. Zuest, Jr.; Fred J. Mayer and Erle R. Jackson. To manufacture and deal in electrical appliances.

BOSTON, MASS.—The National Electric Equipment Company, of Boston, has been incorporated with a capital of $50,000. The president is Charles H. Sprague, of Newton, Mass.

SAN FRANCISCO, CAL.—The Union Electrical Manufacturing Company has been incorporated to do business in San Francisco. It has a capital stock of 50,000 shares at a par value of $1 a share.

NEW YORK, N. Y.—The Kosmos Electric Runabout Company, Manhattan, has been incorporated to manufacture electric vehicles, etc. $100,000. Incorporators: J. H. Kahrs, E. Giovannoni and D. B. Turner, New York city.

READING, PA.—The Reading Chandelier Works is the name of a new concern which is about to engage in the manufacture of electrical and gas fixtures at 440 Woodward street. The plant will occupy the entire three floors and a basement.

SPRINGFIELD, ILL.—The Elgin Electrical Manufacturing Company, of Elgin, has been incorporated to manufacture electrical devices with a capital of $10,000. The incorporators are M. E. Hepburn, L. B. Hamlin, Jr., and C. C. Heywood.

NEW YORK, N. Y.—The Power Equipment Company, of Manhattan, has been incorporated to manufacture engines, boilers, machinery, etc., electrical work. $25,000. Incorporators: L. A. Camacho, New Brighton; G. A. Conover, Bayonne, N. J., and A. M. Mayer, New York city.

LOUISVILLE, KY.—The Ohio Falls Construction Company has been incorporated with a capital of $2,000, to be divided in 200 shares of $10 each, to manufacture electrical supplies. The incorporators are C. A. Duckwall, Theodore Allen, Clifton Brennan and Harry B. White.

INDIANAPOLIS, IND.—Columbia Meter Company, Indianapolis. $10,000. To manufacture electric and other meters. Directors: Gustave A. Schaffer, William H. Pugh and Thomas G. Lee. This company, which has been in business in this city for two years, is incorporated to effect a reorganization.

SALT LAKE CITY, UTAH—The Capital Electric Company has filed articles of incorporation with the county clerk, with $400,000 capital stock, at $1 per share. The officers are: President, R. W. Nicol; vice-president, A. L. Woodhouse; secretary and treasurer, C. W. Corfield. The company takes over the stock of other companies as follows: Butte Electric Supply Company, Electric Fixture and Supply Company, Boisé; Pocatello Electric Supply Company, Idaho Falls Electric Supply Company, Electric Supply and Fixture Company, of Ogden; Salt Lake Electric Supply Company, Electric Manufacturing and Repair Works, Salt Lake; Citizens' Electric Company, Salt Lake; interest in the Utah Electric Company, and now the Capital Electric Company. Of the new stock 174,000 shares will be owned by Mr. Nicol. Twenty thousand shares will be owned by employés of the company, managers, superintendents and the like. The value of the real estate acquired amounts to $173,748.

DATES AHEAD.

Michigan Electric Association. Annual meeting, Grand Rapids, Mich., August 18-21.

International Association of Municipal Electricians. Annual convention, Detroit, Mich., August 19-21.

Ohio Electric Light Association. Annual convention, Put-in-Bay, Ohio, August 25-27.

Colorado Electric Light, Power and Railway Association, Glenwood Springs, Col., September 16-18.

Old Time Telegraphers' and Historical Association, and Reunion of Military Telegraphers, Niagara Falls, N. Y., September 16-18.

Illuminating Engineering Society. Annual convention, Philadelphia, Pa., October 6-7.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Accountants'. Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Claim Agents' Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Engineering Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Manufacturers' Association. Annual convention, Atlantic City, N. J., October 12-16.

American Electrochemical Society. Fall meeting, New York city, October 30-31.

INDUSTRIAL ITEMS.

THE AJAX LINE MATERIAL COMPANY, Chicago, Ill., states that under date of July 10 the examiner in interferences announces that "it is adjudged that the Ajax Line Material Company is the owner of the trade-mark and is entitled to the registration." This is in reference to the trade-mark "Ajax."

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., has recently opened another branch office on the Pacific Coast. The San Francisco office is now supplemented by one in the Colman Building, Seattle, Wash., in charge of W. R. Hendrey, who is well known in the electrical field on the coast.

W. R. OSTRANDER & COMPANY, 22 Dey street, New York, N. Y., has published the fifteenth edition of their 690-page catalogue and discount sheet. This is one of the most complete listings of electrical apparatus published. The value of the catalogue is enhanced by the careful and comprehensive index, making reference easy.

THE F. BISSELL COMPANY, Toledo, Ohio, has added another postal card to its series of "Bissell Frog" souvenirs, showing the enthusiastic batrachian fishing for orders—and getting them. The company is also distributing some interesting literature devoted, respectively, to Wagner measuring instruments, Perkins snap switches, "Security" conduit rods, and Bryant "New Wrinkle" sockets and Bryant "Chapman" receptacles.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., is distributing several bulletins devoted to the Hoyt voltammeter for ignition testing, the Hoyt voltmeters and ammeters for direct current, the Hoyt battery power gauge for ignition batteries, type 35 Hoyt voltmeters and ammeters for direct current for portable and switchboard use, and the Hoyt voltammeter for testing ignition batteries. The company has commenced the publication of a monthly bulletin in which may be found items of particular interest to the automobilist and the user of ignition apparatus.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing an attractive folder entitled "'Tis of the Home We Speak," the circular being devoted to a well-written description of its new lighting fixtures, manufactured by the Price-McKinlock Company, Boston, Mass. The circular should be found of considerable interest to architects, or those contemplating the installation of attractive lighting fixtures. Especial attention is called to the new studios at 264-270 Fifth avenue, Chicago, where a large number of original designs in lighting fixtures are shown.

THE LORD ELECTRIC COMPANY, 213 West Fortieth street, New York, N. Y., has ready for distribution bulletin H, devoted to lightning protective devices. This bulletin gives a brief discussion of lightning phenomena and describes in detail the principles and mechanical and operating features of the Shaw lightning arrester. Several models are illustrated. The bulletin also describes and illustrates the ground points, plates and contacts which it has developed, and considerable valuable data are given concerning the auto-discharge choke-coil, the vertical-unit choke-coil, the laminar-unit choke-coil, and high-tension disconnecting switches.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., in bulletin No. 4603, describes and illustrates an arc lamp especially suited to the illumination of mills and factories, where the vibration caused by machinery and the variation in line voltage resulting from the use of motors for machine drive have made imperative the design of a lamp of this character. This is a multiple lamp, to operate on 220 volts, direct current. Bulletin No. 4600 describes various types of controllers for use with both alternating-current and direct-current motors, on electric cars, locomotives, automobiles, launches, elevators, trains, hoists, etc., and also in rolling mills, machine shops, printing plants and pumping stations. The bulletin describes the controller most suitable for a specific purpose, and contains general data and dimensions which will be found of value to any one contemplating the installation of motor drive.

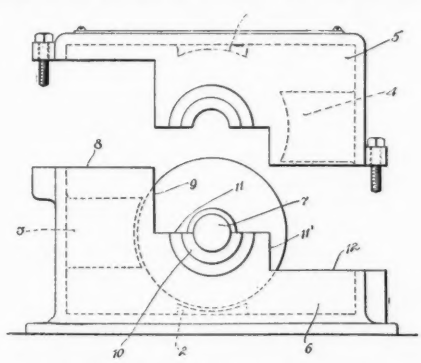
Record of Electrical Patents.

Week of July 21.

893,606. MAGNETIC SEPARATOR. Charles G. Buchanan, Brooklyn, N. Y. The ore is moved by a conveyor through a uniform magnetic field for part of the travel, the exciting magnets being short-circuited during the remainder of the time.

893,618. ELECTRIC TRANSFORMER-FURNACE. Otto Frick, Stockholm, Sweden. A rotatable induction furnace.

893,681. DYNAMO-ELECTRIC MACHINE. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. A dynamo casing separated into two parts along three horizontal and two vertical planes.



893,681.—DYNAMO-ELECTRIC MACHINE.

893,701. MACHINE FOR EXTRUDING METALS. George H. Benjamin, New York, N. Y., assignor to the Coe Brass Manufacturing Company. The metal to be extruded is maintained molten by an electric heater.

893,711. FIELD MAGNET FOR DYNAMOELECTRIC MACHINES. Abe L. Cushman, Concord, N. H. The pole-pieces are provided with removable flaring tips forming substantially V-shaped lateral notches for concentrating the flux.

893,730. RAILROAD-SWITCH SIGNAL. William H. Harris, Stark, Mont. The signaling circuits are closed by means of a knife-edge actuated by bell crank.

893,731. ELECTRIC SIGNAL FOR RAILWAYS. William H. Harris, Stark, Mont. The track is divided alternately into long and short blocks, each of the former being connected in circuit with a succeeding short block.

893,742. LIGHTNING ARRESTER. Ralph D. Mershon, New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company. A series of grounded discharge paths are connected in multiple and are arranged to have successively higher striking potentials.

893,783. ELECTRIC HEATER FOR SHOE-OPERATIVES' KNIVES. Edwin N. Chandler, Brockton, Mass., assignor to Simplex Electric Heating Company, Boston, Mass. A plate heated electrically against which the knife blades are held by a clip.

893,811. ELECTRICAL CONDENSER. Greenleaf W. Pickard, Amesbury, Mass. The condenser coatings are attached to the glass base by a silicate binder.

893,814. DEVICE FOR PRODUCING ELECTROLYTIC METAL-PLATING. Albert Schmitz, Brussels, Belgium. The metal plate is passed continuously through the plating bath, sliding contacts being provided for collecting the current.

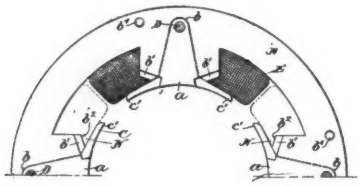
893,816. STARTING DEVICE FOR MERCURY-VAPOR APPARATUS. George Schwarz and Josef Amon, New York, N. Y. The starting device is a plunger in a branch circuit controlled thermally.

893,820. INTERCOMMUNICATING TELEPHONES. Henry C. Thomson, Boston, Mass., assignor to Electric Goods Manufacturing Company, Boston, Mass. A casing for mounting an intercommunicating telephone instrument.

893,835. FIELD-MAGNET FOR DYNAMOELECTRIC MACHINES. Abe L. Cushman, Concord, N. H. The poles have a longitudinal recess extending throughout the length of the pole-piece into which a removable section is inserted.

893,857. FLEXIBLE CONDUIT. George A. Lutz, New York, N. Y., and Clarence C. Sibley, Perth Amboy, N. J., assignors to American Circular Loom Company, Portland, Me. The lining of the conduit has series of rows of perforations at distances apart, the rows being at an angle to the length of the conduit.

893,880. SWIVEL-JOINT FOR ELECTRIC CURRENTS. Augustus B. Smith, Wilkinsburg, Pa. Both portions of the joint are provided with terminals, a rolling current-transmitting device being placed between.



893,711.—FIELD-MAGNET FOR DYNAMO-ELECTRIC MACHINE.

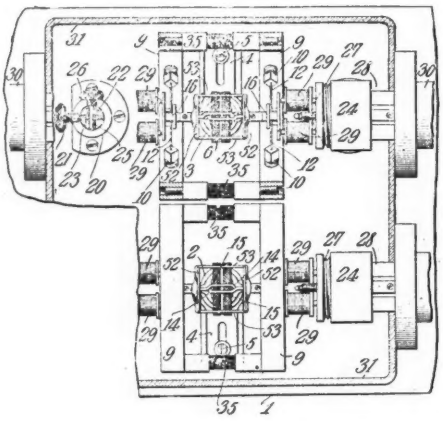
893,891. HAND TELEPHONE SET. George F. Atwood, East Orange, N. J., assignor to Western Electric Company, Chicago, Ill. A waterproof hand telephone, the talking switch being entirely enclosed.

893,902. ELECTRICAL PERMUTATION-LOCK SYSTEM. Henry T. Cleary, St. Louis, Mo. A lock controlled by a number of electric circuits.

893,918. THERMOSTAT. William F. Gossick and Arthur R. Van Valkenburgh, Chicago, Ill. A two-part thermostat, the part containing the heat-responding device being removable.

893,936. ELECTRIC REGULATION. Morris Moskowitz, New York, N. Y., assignor to the United States Light and Heating Company, New York, N. Y. A regulating system for controlling a generator when charging a storage battery.

893,953. TELEPHONE RELAY. Charles W. Underwood, Crowley, La. A relay consisting of two telephone-receiver magnets in series with a telephonic transmitter, and an armature in operative relation to each magnet.



893,953.—TELEPHONE RELAY.

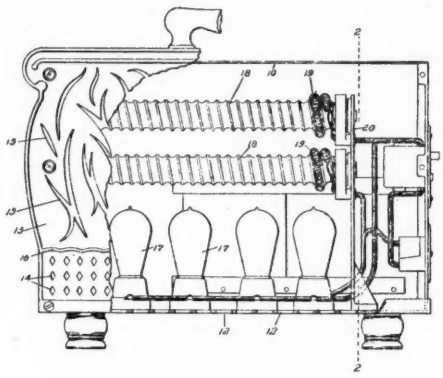
893,979. DYNAMOELECTRIC MACHINE. James Burke, Erie, Pa., assignor to Burke Electric Company. The armature has two windings, one consisting of twice as many turns as the other.

893,994. ILLUMINATED ELECTRIC HEATER. Francis C. Green, New York, N. Y., assignor to Consolidated Car-Heating Company, Albany, N. Y. The heating casing is perforated so as to imitate a flaming fuel bed.

893,997. DISTURBANCE-OPERATED CIRCUIT-BREAKER. Leo D. Haas and Edwin G. Derbidge, San Jose, Cal. The actuating magnet circuit is closed by a pendulum switch whenever the device is disturbed.

894,142. TELEGRAPH TRANSMITTING INSTRUMENT. Frederick H. W. Higgins, London, England. A type-printing telegraph.

894,143. PERFORATING PUNCHING MACHINE, ETC. Frederick H. W. Higgins, London, England. A perforating machine for a type-printing telegraph system.



893,994.—ILLUMINATED ELECTRIC HEATER.

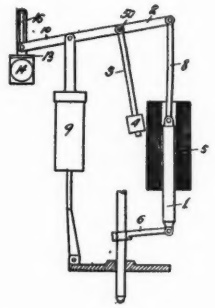
894,144. ROTOR FOR DYNAMOS AND ELECTROMOTORS. Jack Hissink, Berlin, Germany. The end turns of the rotor conductor are enclosed in separate supporting rings.

894,150. LIGHTNING ARRESTER FOR ELECTRICAL CIRCUITS. Ralph B. Ingram, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A series of spark-gaps which are shunted by successively decreasing amounts of ohmic resistance.

894,157. PROCESS FOR OPERATING ELECTRIC-ARC LAMPS IN SERIES. Frank M. Lewis, Brighton, England, assignor to General Electric Company. The lamps are controlled by series-regulating coils only.

894,158. ELECTRIC ARC LAMP. Frank M. Lewis, Brighton, England, assignor to General Electric Company. An arc lamp for constant-potential series circuits, which is controlled by a series magnet only.

894,166. MEANS FOR PRODUCING AND UTILIZING RAYS OF LIGHT FOR THERAPEUTIC PURPOSES. Corydon E. Rogers, Seattle, Wash., assignor, by mesne assignments, to the Rogers Therapeutic Lamp Company, Phoenix, Ariz. A reflector for an incandescent lamp.



894,158.—ELECTRIC LAMP.

894,167. KEYBOARD. Adolph H. F. Shaar, San Francisco, Cal., assignor to United States Wireless Printing Telegraph Company, Los Angeles, Cal. A plurality of contact levers for telegraphic purposes.

894,170. TELEPHONE REPEATER SYSTEM. Nathaniel G. Warth, Columbus, Ohio. A telephone relay composed of two induction coils and two transmitting devices, the latter being controlled by independent electromagnetic means.